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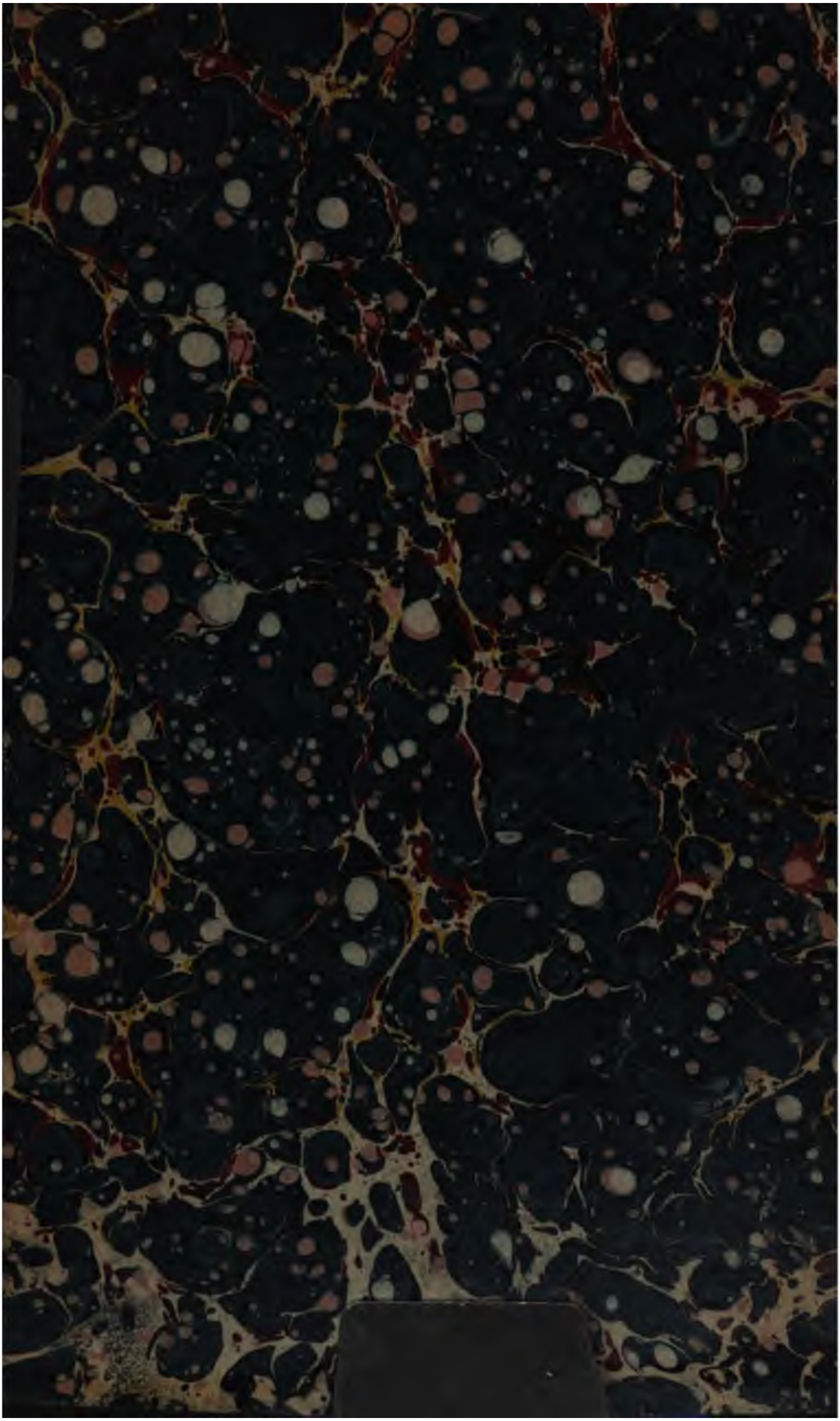

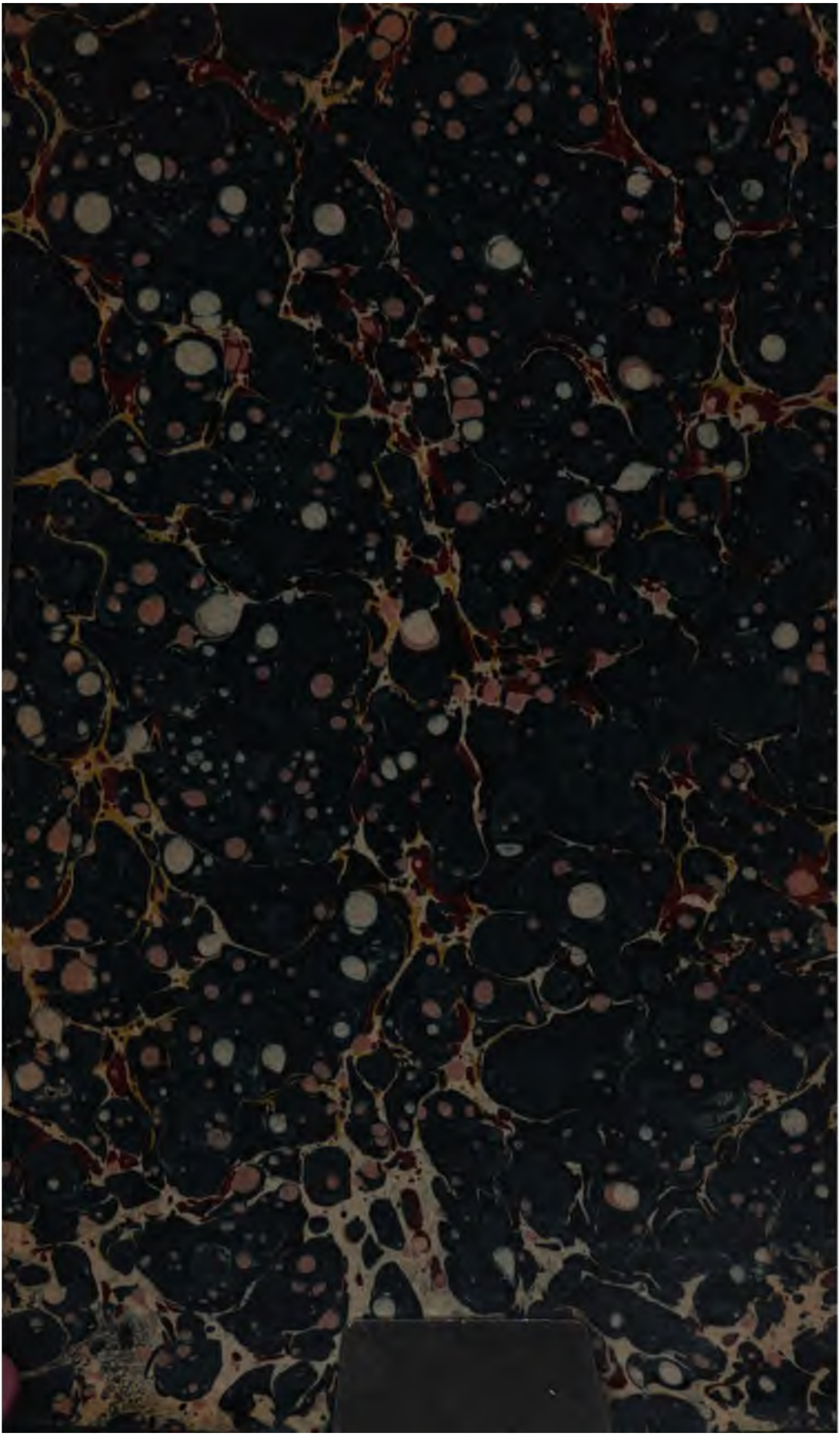

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RANZANIA MAKUA

LITH. [illegible] & KEY. SC.

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ON THE VARIOUS STAGES OF DEVELOPMENT OF SPERMATOBIUM, WITH NOTES ON OTHER PARASITIC SPOROZOA.

BY GUSTAV EISEN.

[With Plate i.]

Spermatobium nov. gen.

The hosts of this parasitic sporozoan are two oligochæta, *Eclipidrilus frigidus* and *Phœnicodrilus taste*, both found on the Pacific Coast of North America, the former in the Californian Sierra Nevada at high altitudes, the latter in the mountains of the Cape Region of Baja California, Mexico, at an altitude of about 4,000 feet. In both hosts the Spermatobium is confined to the sperm-sacs, where in the young stages it occupies the interior of a sperm cell, but in later stages lives free in the sperm-sac outside the sperm cells.

Although in the following I have described all the various stages as belonging to one and the same form, it is evident that we here have to deal with two distinct species, of similar structure, but differing very markedly in size of the adult, but principally in the size of the cytospheres. That this difference is not dependent upon the host in which they live is evident from the fact that the Spermatobium inhabiting the smallest host is the largest and possesses the largest cytospheres, while *vice versa* the larger host houses the smaller species with the smaller cytospheres. While in one and the same individual host the size of the adult Spermatobia may differ some, I have never observed the cytospheres of the respective specimens to differ; this of course makes the difference in size of the cytospheres in the two species to be of great importance. I believe, therefore, I am justified in establishing two species, especially as I may thereby call attention to similar differences in other sporozoa.

Spermatobium Freundi n. sp. Figs. 1 to 4, 6 to 9, 11 to 18, 20 to 32, 34 to 37, 39 to 41, 43 to 45.

Host, *Phœnicodrilus taste*, an oligochæt from the Sierra El Taste in the Cape Region of Baja California, Mexico.

Adult and sporogonium (pansporoblast) about one-half the diameter of those of the following species. Cytospheres about half the diameter of those of the following species.

Spermatobium eclipidrili n. sp. Figs. 5, 10, 19, 38, 38, 42.

Habitat. In my late paper on Eclipidrilus I have referred to the occurrence of this annelid in two separate localities at different elevations. One is a cluster of springs on the south slope of the middle fork of King's River in California, at an altitude of about 11,000 feet. The water in these springs is very cool—icy, in fact—very clear, transparent, without apparent trace of suspended sediment. The bottom is very sandy, here and there covered with water mosses. The hosts of Spermatobium live in the sand or fine sediment among the roots of the moss, etc.

In another locality, the Three Spring Meadow on the north fork of King's River, this protozoa was not found, though Eclipidrilus is common there, too. The water in these springs is less pure with more sediment, and the Eclipidrili were found crawling in decayed wood, etc. The altitude was only about 7,000 to 8,000 feet. I refer thus in detail to these localities, because other protozoa *Hæmagregarina nasuta* were found to infest in countless numbers the same hosts, from the higher altitude and the purer and cooler water, while in those from the lower locality and the less pure water they were totally absent—that is, the *Hæmagregarina nasuta* as well as *Spermatobium eclipidrili.*

Phœnicodrilus taste occurs in the mountains of the Cape Region of Baja California, at an altitude of 4,000 feet, and lower down to the coast, about fifty to sixty miles north of Cape San Lucas.

METHOD OF INVESTIGATION.

The Eclipidrili were in rather poor state of preservation, having been hardened and kept in alcohol. The Phœnicodrili had been carefully fixed in a solution of corrosive sublimate and afterwards hardened, some in absolute alcohol, others in formaline. But notwithstanding the different conditions of the hosts, the protozoa did not show any prominent difference in structure, the caryoplasm only being less distinctly stained in the alcoholic specimens. I am therefore satisfied that the structure here represented and figured is the real one. This I believe with the more confidence as Beddard has shown that the protozoa—Gregarina of Perichæta—do not generally change their form and structure, even when attacked by powerful reagents. Much of the success in observing protozoa depends upon the staining, especially so in this form, which was not greatly sensitive to the common stains of hæmatoxylon, methyl green, safranine, etc. After having tried a dozen or more stains at my disposal, I found the following method to be superior to any other, and to give by far the finest nuclear images:

1. Staining of the hosts in toto in very weak Delafield's hæmatoxylon or in Ehrlich's ammonia hæmatoxylon.
2. Hardening and sectioning in paraffine.
3. The slide fixing consisted simply of distilled water

never be melted, but the paraffine dissolved in pure turpentine or xylol.

When the latter is at last removed by alcohol the slides are stained by a saturated solution of orange G. in 33 per cent. alcohol. The stain should be left on only a few seconds, then immediately washed off in 95 per cent. alcohol. If too darkly stained wash gradually off with weaker alcohol until the proper tint has been found. It is better not to have the shade too bright yellow. Pure water will wash out all of the stain.

If it is found that nuclei of the hosts are not sufficiently brightly or darkly stained by the hæmatoxylon, the slide may be again stained by a weak solution of Ehrlich's ammonia hæmatoxylon, under the microscope. Clear with oil of bergamot, mount in gum-thus in xylol. Such sections give exceedingly good images. The nuclei of the hosts were stained by the hæmatoxylon, while the nuclei of the protozoa were stained by the orange and well differentiated. The nucleoli were nearly always stained deep yellow, while the other part of the nucleus was lighter; chromosomes and microsomes in the nuclei were always stained very dark brown. The cell plasma of the protozoa were stained lightly by the hæmatoxylon. A prolonged staining with only hæmatoxylon would stain the protozoa nuclei, but such prepared sections did never show the elements and structure of these nuclei.

I will also here call the attention to the very great advantages of gum-thus in xylol as a mounting medium, it giving images far superior to those by canada balsam or damar.

IMMATURE INTRACELLULAR STAGES. Fig. 1*a*, *b*, *c*.

The youngest stages of Spermatobium which I have been able to observe are seen in the spermatogonium, or the mother sperm cell after it has dropped from the testis into the sperm-sac. This stage is intracellular, the parasites having entered the cell and are feeding on its contents. In size the young Spermatobium is there not any larger than the fully developed spore (fig. 1*a*, *b*, *c*), though I do not thereby wish to say that it is the spore which has been transformed into an immature Spermatobium, as on this point I am yet in doubt. This stage is but slightly larger than the nucleus of the spermatogonium of the host (fig. 1*a*).

The protozoan may at this stage be described as a small cell with nucleus and nucleolus, the cell being of various forms, round or oblong, the nucleus always round and the nucleolus globular and well defined. Generally, however, the protozoan is pointed oviform, as in the fig. 1*a*. In the following I will always refer to the two or three principal parts of the protozoan as cell or cytosome, nucleus or caryosome and nucleolus, the definitions of which are the general accepted ones. The cytotheca is thin and structureless, frequently wavy and ruffled.

THE CYTOPLASM.

As the intracellular protozoan grows, it gradually fills out the larger part of the host's spermatogonium. The nucleus of the latter, however, remains intact to the last, and I am doubtful if it is really at any time consumed by the parasite. Fig. 1*b* shows this stage of the protozoan. The remains of the spermatogonial cytosome is seen outside of the edges of the protozoan. On the figure they are slightly colored yellow; on the slide, however, they were stained light blue by the hæmatoxylon, only the nucleolus of the spermatobium having taken the yellow stain. As will be seen from this figure, the nucleus and nucleolus of the spermatobium have obtained their full size, which, however, is variable in different individuals, in this instance being unusually large. The nucleus of the spermatogonium shows yet plainly its chromosomes, which apparently have not been in the least affected by the parasite.

FREE IMMATURE STAGE. Figs. 2, 3.

In this stage the protozoan is seen free from the spermatogonial host, living an intercellular life in the fluid surrounding the various developmental stages of the spermatozoa in the sperm-sac of the host. This mode of existence is kept on until after the formation of the spores or sporocysts. In fig. 2*a* is represented a young spermatobium lately having left the spermatogonium of the host. Its nucleolus is large and has taken the stain deeply. The boundary of the caryosome is at this stage often even forming a globe; but this is not always the case, nor is it typical of this stage, as both previously in the intracellular form (fig. 1*b*), as later (fig. 2*b*), may the caryotheca be wavy and irregular in outline. In fig. 2*a* the cytoplasm is seen to be differentiated, there appearing several pellucid vacuoles at the apex. In fig. 2*b* the cytoplasm forms a network, consisting entirely of a grainy matter with a few more deeply staining microsomes. If this stage is previous to or later than the one represented in fig. 2*a*, I am not able to say.

After these stages are passed the spermatobium assumes a broader shape, and at the same time the cytoplasm is seen to be differentiated. Clear, rounded, pellucid sacs or vacuoles of different size begin to form in the center of the cell, while at the surface below the cytotheca are seen accumulating very small, extremely regular, globular bodies. The former I term for the present simply vacuoles, the latter cytospheres. The vacuoles are first seen in the vicinity of the nucleus and opposite to it (figs. 3*a* and 38*b*). Their contents do not stain, but in some I could detect a faint shading in their center. They are of different sizes; the largest appear nearest the center, the smaller further away, or mixed in with the other in an irregular manner (fig. 3*a*). The cytospheres are at first few and gradually increase in number. Correspondingly the vacuoles decrease in number and size, and at last the protozoan cytoplasm contains nothing but cytospheres of the same size and shape, the

In the first stages when the first cytospheres are formed their bodies are somewhat smaller, but they quickly increase in size; at least, the more numerous the larger they are up to a certain point. The first cytospheres are seen only near the surface, below the cytotheca, irregularly distributed in groups, like land and oceans on a map. What I consider the adult individual is solid, so to say, with cytospheres, the vacuoles then having entirely disappeared, and even the interior containing cytospheres.

CYTOSPHERES.

The cytospheres are small, perfectly globular, glassy, pellucid bodies, which do not stain with orange G., and only very faintly with hæmotoxylon, though the latter can hardly be called staining, but may rather be termed soiling. In fact, they remain pellucid to the last, with the exception of a central spot of darker color, the latter, however, not being due to any stain. Soon after the appearance of the cytospheres this spot is seen to be very small, exceedingly well defined and very dark, merely appearing as a single point (figs. 10*b*, 14), sometimes surrounded by a white zone.

At what I suppose a later stage in the cytosphere, this central dot or cytosphero-center enlarges and appears as a small circular disc (fig. 16), also well defined, the boundary being much the darkest. At a later stage yet, the cytosphero-center becomes diffuse, and gradually occupies a large part of the cytosphere. This is the character of the cytospheres at the end of the formation of the sporogonia and sporoblasts (figs. 18, 20). After the pseudo navicella spore is formed, the cytospheres diminish in size, and finally are seen to possess only about one-half the diameter of the original cytosphere (fig. 26). I believe this diminished size is caused by a division of the cytosphere into four parts, as I have observed a number of cytospheres in a spore showing the appearance of division (fig. 33*a*), the dark center remaining outside of the four new microcytospheres. If the division goes still further I am unable to state. It is not unlikely that it does, as no such microcytospheres are seen in the young protozoan. The cytospheres probably correspond with the amyloid granules of Bütschli, and appear to be present in most sporozoa. Besides the cytospheres and the vacuoles the cytosome contains, especially in the earlier stages, a diffuse darker staining plasma (fig. 2*a*, etc.), which, however, mostly disappears from view as the cytospheres accumulate and increase in number. But little of this plasma is seen in the fully developed form, and only rarely is any found in the sporulation stage (fig. 10*a*), and then generally around the nucleus.

NUCLEUS.

A nucleus is nearly always present and well developed, though the chromatin bodies are not well definable. The nucleus shows some very decided phases of development and differentiation proceeding along two different lines, accordingly as its division is caused by simple budding possess a nucleolus, of distinct form and appearance, which I will describe later on. In its earliest stage the nucleus is clear, globular, surrounded by a circular caryotheca of considerable thickness. As, however, I have frequently found the outline rosette-like (figs. 41*c*; 1*b*), I believe that it possesses an amœboid movement, already in the very early stage, when the protozoan is yet confined to the spermogonium of the host (fig. 1*b*). In most of the intercellular Spermatobia the caryotheca was wavy, slightly folded, showing signs of having altered its shape (fig. 41*c* and *d*). Some, however, possessed the regular circular outline. The caryotheca always stains readily but not deeply with the orange G. Of the contents of the caryosome—disregarding the nucleolus for the present—I could sometimes distinguish two different substances: one protoplasmatic, by far the most abundant, and also a darker staining, more regularly grained part, probably the chromosomes. How far these respective substances in the resting nucleus correspond with the chromosomes and microcaryosomes, etc., of higher nuclei I am unable to say, as they are not well differentiated until in the latter stages of sporulation, where chromosomes and filaments may be distinctly recognized. We may distinguish several distinct stages of nuclear development, each one of which presents some characteristics of importance:

1. *Resting macronucleus*, with perfect caryotheca, diffuse caryoplasma, single large nucleolus with several intranucleolar bodies.

2. *Amœboid nucleus*, or the first stage of sporulation in which the former resting macronucleus divides itself in numerous micronuclei by an apparently amœboid budding or diffusion of the caryoplasm in among the cytospheres. The amitotic stage.

3. *Micronuclei, or contracting stage*, in which the diffused caryoplasm is concentrated at regular intervals, forming a large number of micronuclei.

4. *Caryokinetic stage*, in which the micronuclei further divide by caryokinesis.

In the early stages of the macronucleus the caryoplasm is small in quantity, generally arranged along the inner wall of the caryotheca (fig. 3*b)*, staining in places more darkly, probably as small chromosomes.

In the more developed protozoan the caryoplasm fills a large part of the caryosome, is of a streaky, ramified nature, the ramifications evidently proceeding from a center near or around the nucleolus (figs. 7, 41). In unstained specimens the nucleus appears always as a light round spot, with the darker nucleolus in the center. It is first only at a more advanced stage that it takes the stain.

In the fully developed Spermatobium the caryoplasma stains freely yellow, but not as deeply as the nucleolus. Even a prolonged exposure to hæmatoxylon fails to stain it in a distinct way, and it is entirely due to its affinity to orange G. that it becomes well defined. The most inroblasts and shuttle spore. In every such instance I found the arrested or undeveloped sporogonium deficient in or entirely without nucleus, only possessing cytospheres. I believe that it is want of sufficient nuclear matter which has caused the development of sporoblasts to cease. In fig. 45 I have figured such a Spermatobium in which a part has been arrested in its development while the other has already produced spores. How this deficiency in caryoplasm originated in this instance I cannot say, but it may depend on two distinct causes: either the caryoplasm moved the larger part of its bulk to the part which later on developed, this as I believe causing a division of the original sporogonium into two smaller sporoblast, or the caryoplasm may from some cause or other have been destroyed in one sporoblast while not in the other. That the two sporoblasts originally belonged to a single pansporoblast I judge from the remains of the original cytotheca, which is yet seen surrounding the two sporoblasts.

NUCLEOLUS.

But before I describe this diffusion and subdivision of the nucleus proper, it will be in order to consider the form, structure and nature of the nucleolus. I believe it safe to say that the nucleolus is always present, even if not always under the same form and of the same size. I have never seen a single fully developed Spermatobium which did not possess a nucleolus of some size, small or large, and when the caryoplasm diffuses the nucleolus remains, though sometimes in greatly diminished form, until the very last, when its final division or disintegration takes place; it apparently does not move with the caryoplasm.

In its perfect form, even in the intracellular stage of the Spermatobium, the nucleolus consists of one single, globular body, varying in size from one-third to three-fourths the diameter of the nucleus. It is nearly always very regular in outline, strictly globular, and in its early stages shows a homogeneous consistency, its plasma staining intensely and evenly with orange G., but not with hæmatoxylon nor with methyl green, and only faintly with safranine (figs. 1*b*; 4*b*; 7*b*; 41*d*, etc.). In the free Spermatobium the nucleolus always contains one or more, up to six, minute round intranucleolar bodies of different sizes and of an intensely light-refracting nature.

These intranucleolar bodies are often, but not always, surrounded by a transparent sphere, like a vacuole (fig. 4*b*). In very young Spermatobia they are absent or few in number; in adult specimens again they are more numerous, and I have counted six or eight—some larger, some smaller (fig. 41*d*.) In a young Spermatobium the nucleolus appears homogeneous, but in older specimens, especially those which are in the stage of division by sporulation (fig. 10*b*), I have nearly always found the nucleolus to contain a number of round, lighter-appearing globules, which certainly do not appear as if they were vacuoles, but rather as differentiated nucleolar matter.

I have also but rarely seen a vacuole. At other times

1. Budding proper of the caryoplasm, by means of fine, thread-like elongations from the nucleus proper.

2. Formation of caryoplasmic nodes at certain at first irregular, later on at regular intervals.

3. Growth of these nodules by attraction and contraction of the outlying caryoplasmic threads.

4. Final division of these secondary or micronuclei by caryokinesis and their moving apart, forming the final nuclei preparatory to the formations of the pseudonavicella spores.

5. To this may be added the division or disintegration of the nucleolus, which takes place later on, and which does not appear to be of importance in the formation of the micronuclei. In some instances the nucleolus remains intact for some time after the division and redistribution of the caryoplasm.

The first indication of a division of the macronucleus is seen in the unequal ·distribution of the caryoplasm within the caryotheca. The latter at the same time assumes an irregular outline and soon disappears entirely (fig. 7*a* and *b*). But even before the caryotheca has vanished, the caryoplasm has penetrated its walls and accumulated outside of, but adjacent to the latter. From these agglomerations caryoplasmic filaments are seen extending irregularly in all directions (figs. 7 and 8). These caryoplasmic filaments when properly stained may be found extending all through the cytospheres, winding their way between them. At certain intervals there appear thicker nodes on the filaments and from these nodes other filaments radiate in various directions. At last a stage in radiation has arrived when nodes are found at fairly regular intervals throughout the cytosome (fig. 9*a* and *b*). At this stage there frequently or nearly always appear one or more darker staining bodies in the nodes, possibly developing chromosomes, preparatory to final caryokinesis.

These nodes appear to absorb the outlying caryoplasmic filaments by which they were at first connected with the mother or macronucleus. During all this radiation of the caryoplasm, the original caryosome appears to be growing in size, and it is able to furnish plasma for forty to sixty micronuclei before diminishing in size, while frequently it becomes much larger than in its early resting stage. Finally, however, the original caryosome generally entirely disappears, though this may not always be the case, as sometimes (as, for instance, in the case figured at 10*a*) a part of the caryosome as well as some cytoplasm remains after the sporoblasts have already been formed. In this figure to the upper left of the nucleus is seen a bluish mass, consisting of caryoplasm and unused cytospheres. The nucleus, colored yellow, has evidently contracted its caryoplasmic filaments, as none could be seen either around the remains of the macronucleus or around the micronuclei. The nucleolus again has been broken up into one larger and three smaller nucleoli. The larger one of these (figured separately 10*b*) sporoblasts with inclosing membrane, the outline of which is more or less distinct, accordingly as the spheres are packed closer or looser together.

4. The division of the micronuclei is not effected by the budding process, but by division in equal parts by caryokinesis.

DIVISION BY CARYOKINESIS.

After the cytospheres have been attracted into sporoblasts, each one surrounded by a thin membrane, the micronucleus begins again to divide. But now the division is not effected by budding but by a distinct caryokinesis. Small chromosomes may be seen scattered about at first irregularly; later they congregate at the equator, and finally caryokinesis takes place. I have, however, not been able to observe either asters or centrosomes, the highly refractive cytospheres so far obscuring observation.

Fig. 12 represents such a sporoblast with a single micronucleus. In Fig. 13 the nucleus has divided into two, which have moved to opposite poles, and these secondary micronuclei have again divided. The two upper ones are yet connected by a caryoplasmic filament.

DISINTEGRATION OF THE NUCLEOLUS.

The first indication of a disintegration of the nucleolus is a blurred outline, caused by small irregular drops, staining exactly as the nucleolus, appearing on the outer circular surface of the nucleolus (fig. 8*b*). Smaller, more or less irregular globules are seen in the caryoplasm near by, and in more advanced specimens nucleolar fragments are seen in the various or in some of the caryoplasmic nodes. Sometimes one of these new nucleoli are larger than others, staining either darker or lighter than the surrounding caryoplasm. Around such caryoplasmic nodes the cytospheres are seen to arrange themselves regularly.

In the majority of the new cytoplasmic micronuclei I have not been able to see the nucleoli, but I think it is safe to say that they are frequently present. As to the relationship of the nucleoli found in the micronuclei with that of the macronuclei I cannot say anything with certainty from observation. I believe, however, that the nucleolus of the macronucleus dissolves sooner or later, and that the nuclei found in the micronuclei are really new elements not directly derived from the macronucleus. Generally, however, the nucleoli remain conspicuously, though of diminished size, long after the macronuclei have all diffused themselves through the cytoplasm. In the newly formed spores more or less numerous highly refractive bodies are seen, greatly resembling the internucleolar bodies and probably identical with them.

Since the above was written and presented for publication, I have received the paper by Dr. L. Rhumbler on "Die Enstehung und Bedeutung der Binnenkörper," and I am pleased to say that I find in his explanation of the structure and action of the nucleoli a satisfactory sostructures but only accumulations of organic secretions of different states of liquidness, appears to explain the nucleolar structure of Spermatobium.

SPORULATION.

The sporulation is undoubtedly the chief object of the adult Spermatobium, and it depends chiefly on this process for the maintenance of the species. In the various phases of sporulation we have, in fact, the larger part of the life history of this protozoa. Sporulation, or the forming of spores, comprises again various stages of development. These are:

A. Preparatory stages and amitosis.
   1. Diffusion or budding of macronucleus.
   2. Formation of numerous micronuclei.

B. Formation of spores.
   3. Attraction by the micronuclei of cytospheres, forming sporoblasts.
   4. Divisions of micronuclei by caryokinesis.
   5. Transformation of each sporoblast into a shuttle spore.
   6. To this may be probably added another stage, the formation of sickle germs in the shuttle spore. This stage I have not observed, and its existence can only be inferred from what takes place in other protozoa.

When the adult Spermatobium has begun the process of sporulation it may be more properly called a sporogonium or rather macrosporogonium, as at a later stage this macrosporogonium divides into numerous microsporogonia. The smaller agglomerations of cytospheres and micronuclei may again be termed sporoblasts.

Strictly speaking, the sporulation begins with formation of sporoblasts. After the micronuclei have contracted their plasma filaments and attained their proper

4. In one or more of the separating individuals, the process of sporulation—forming of a sporogonium—may be more advanced than in any of the other parts, while all are yet connected together.

5. The formation of a new perfect nucleus as in fig. 41, probably depends upon the accidental accumulation of sufficient nuclear matter in one place.

LARGER CYSTS.

In figs. 43 and 44 I have figured two very large and unusual forms. One of these is a very young form, irregular in outline, with very small cytospheres and no nuclei. The other is undoubtedly a sporogonium stage, with a very thick cytotheca, if we here have to deal with a formation of a different kind of cyst or with abnormal forms of the common cyst is undecided.

I found only few of these forms and only in the Eclipidrilus host.

AFFINITIES.

The characters of Spermatobium appears to be intermediate between Klossia and Monocystis, and I think in Spermatobium are found numerous microsporogonia of nearly equal and very regular size as in Klossia. The adult Spermatobium differs from Monocystis in its general form. The pointed apices and epimerit are not seen in Spermatobium, which is more regular, oval, globular or slightly lunate with rarely projecting apex. The ciliated covering, consisting of abnormally developed spermatogonia of the host, found in Monocystis are not seen in Spermatobium.

Finally, the form and structure of the nucleus and nucleolus in Spermatobium agrees more with those of Klossia than with those of Monocystis.

The life history of Spermatobium is shortly as follows:

RÉSUMÉ.

The young Spermatobium is intracellular parasitic in the spermatogonium of the hosts Eclipidrilus and Phœnicodrilus, but it leaves these cells before the spermatoblasts have begun to grow. The free form is shuttle-like, later ovoid and finally globular, with extremely prominent nucleus and nucleolus. In the cytoplasm of the Spermatobium the cytospheres gradually develop at the expense of or from the other element.

The macronucleus, at first globular, becomes later irregular, and finally diffuses itself all through and between the cytospheres, forming at first nodes which later change into new secondary nuclei equidistant from each other. The cytospheres group themselves around these micronuclei, which latter again divide by caryokinesis, thus forming at first microsporogonia, then sporoblasts. The sporoblasts develop first into shuttle spores. Pseudonavicella spores are also found.

A division of the adult takes place sometimes, probably caused by the accumulation of a too large quantity of nuclear matter in one spot outside of the original nucleus. When the nuclear matter is evenly distributed, the same power of attraction which caused the adult to divide causes the sporoblasts to form, which latter is accomplished by the even grouping of the cytospheres around the secondary nuclei. A thin membrane is formed around the sporoblasts, after which the nucleus of the latter begins again to divide by mitosis.

This budding or amitosis of the nucleus has previously been observed in a large variety of cells, and the various views of respective investigators of this subject have been set forth by Dr. Richard Zander (4) with great clearness. The type of division found in the early sporogonial stage of Spermatobium must, with some allowance, be considered as related to Arnold's "fragmentation" type, though want of access to his paper (3) has prevented me from making a closer comparison.

Ziegler (5) holds that amitosis only takes place in meganuclei, and that these soon perish after the process is over. This is exactly the case with the macronucleus of Spermatobium. Fritz Schaudinn (6) again has described equal or unequal parts, not separated by regular division fields.

Radiation or Budding. The nucleus branches out, forms nodes, which latter by retraction of filaments become independent nuclei—Spermatobium.

Sporulation. The nuclear plasma become by the aid of achromatic filaments divided into numerous equal parts, which, through the bursting of the caryotheca, are set free and form independent nuclei—Foraminifera.

Hæmagregarina nasuta n. sp. Figs. 50 to 64.

This form infests the walls of the blood-vessels and surrounding mesenterium of *Eclipidrilus frigidus* in enormous numbers. The cysts lie so closely that they frequently touch each other, and totally obscure the structure of the tissue of the host, to such an extent that there appears to be more of the parasites than of the tissue. I have only found the parasite in specimens of Eclipidrilus from the locality on the middle fork of King's River, California, at an altitude of about 11,000 feet, while the Eclipidrili found at the lower altitude and in impure water were entirely free both from Hæmagregarina and Spermatobium.

Although the host from the former locality were infested at the rate of thousands, none contained protozoa of different stages of development. I could only observe the fully developed form, all cysts and all spores being absent, the more to be regretted as related forms are only imperfectly known. The relationship of *Hæmagregarina nasuta* must therefore remain in doubt, and my reasons for classing it with Hæmagregarina depend alone upon the appearance of the adult form as well as upon its habitat. As is well known, Hæmagregarinas are principally known through Danilewsky's description of

H. Stepanowi from the blood of Emys, the fresh-water turtle of Europe, and it may be considered fairly certain that all forms related to Hæmagregarina are true blood parasites, principally inhabiting the blood-corpuscles of the vertebrates, turtles, birds and lizards while adult. The spores again are found in the bone marrow of the turtle, the kidneys, spleen and bone marrow of the lizard. This habitat of all the species of this group makes the presence of a Hæmagregarina in the blood of an oligochæt all the more interesting. The want of large blood corpuscles in the blood of oligochæta has made it necessary for our present species to select another habitat, if indeed it is not the original one. Here it is the lining of the blood-vessels and the surrounding mesenterial tissues which are infested, especially so the lining of the blood lacunes in the alimentary canal; in no instance did I find any of these protozoas in the blood itself.

The youngest form was straight, slightly sigmoid, with no well defined nucleus, while the more advanced individuals were folded together like the blade and handle of

EXPLANATION OF THE FIGURES.

PLATE I.

Spermatobium Freundi figures: 1 to 4, 6 to 9, 11 to 18, 20 to 32, 34 to 37, 39 to 41, 43 to 45.

Spermatobium Eclipidrili figures: 5, 10, 19, 35, 38, 42.

All the figures are drawn from parafine sections stained with Orange G. and Ehrlich Hæmotoxylon. All drawings were made under Zeiss Obj. 1-12 hom. imm. Oc. 2. Some of the detail figures were drawn on a larger scale, but not under a higher power.

Fig. 1A. A spermatogonium of the host containing a parasite in very early stage of development.
n. h. nucleus of host.
p. protozoa parasite.

Fig. 1B. Another spermatogonium from the same. The Spermatobium is more advanced in development, having nearly occupied the whole cell, the nucleus of which is yet intact.
n. h. nucleus of the host.
c. h. cytotheca of the host.
n. sp. nucleus of Spermatobium.
v. c. vacuole in the cytoplasm of the parasite.

Fig. 2A. A free Spermatobium. The nucleus is globular, the nucleolus is also globular and well defined. At the apex of the cytotheca are seen the commencement of vacuoles *c. s. b.*

Fig. 2B. Another nearly adult Spermatobium.

Fig. 3A. An adult Spermatobium, with commencing vacuoles.

Fig. 3B. Nucleus of the same.

Fig. 4. Another Spermatobium of more regular form.

Fig. 4B. The nucleolus of the latter drawn on a larger scale in order to show the intranucleolar bodies.
n. nucleus.
no. nucleolus.
no. b. intranucleolar bodies.

Fig. 5. An adult Spermatobium from Eclipidrilus.
cys. cytospheres.
n. nucleus.
no. nucleolus.

Fig. 6. Surface view of a Spermatobium Freundi, showing the cytospheres and their relative size compared to those of Spermatobium eclipidrili.

Fig. 7A. An adult Spermatobium, with nucleus in a stage of budding.

Fig. 7B. The nucleus and nucleolus of the latter.

Fig. 8A. An adult Spermatobium, with a nucleus yet more advanced in budding, nodes and micronuclei already having formed in places.

Fig. 8B. The nucleus and nucleolus of the same drawn on a larger scale
- *no.* nucleolus in a state of disintegration diffusing nucleolar matter.
- *n. m.* nucleolar matter.
- *no.* intranucleolar bodies.
- *nd.* nodes or forming micronuclei, by contraction of the nuclear filaments, or by accumulation of the caryoplasm of two different kinds.

Fig. 9A. Another Spermatobium in which the caryoplasm has been partly, but yet irregularly distributed.
- *n. n.* new larger nucleus with distinct nucleolus.
- *n. d.* new nucleus in a state of mitosis.

Fig. 9B. A part of the former drawn on a larger scale.
- *n.* remains of macronucleus.
- *n. d.* macronuclear node division.
- *nc.* macronucleus around which the cytospheres are grouping themselves. Smaller nodes are seen scattered about some of which are yet connected by caryosomic filaments.

Fig. 9C. A smaller specimen with diffusing nucleus around the vacuoles.

Fig. 9D. Spermatobium Freundi with large budding nucleus and large nucleolus. Vacuoles and cytospheres not drawn.

Fig. 9E. Part of a resting nucleus with two extra nuclear bodies of unknown nature, possibly nucleolar ejected matter.
- *cyt.* cytoplasm.
- *nob.* nucleolus.
- *en.* ejected nucleoli.

Fig. 10. Spermatobium eclipidrili, transforming into an encysted sporogonium.

Fig. 13. A sporoblast with nuclei in mitosis.

Fig. 13B & C. micronuclei with chromosomes at end of mitosis.

Fig. 14. Another sporoblast with single nucleus.

Fig. 15. A sporoblast in which the centers of the cytospheres are more developed, micronuclei not eliminated.

Fig. 16A. A sporogonium, with developed sporoblasts, a stage further advanced than the one figured in 10A.

Fig. 16B. One of the sporoblasts drawn on a larger scale, showing three micronuclei.

Fig. 16C. A nucleus and a cytosphere of the former.

n. nucleus.

cy. cytosphere..

Fig. 17. Two sporoblasts with nuclei in a state of division. A large sporoblast has just divided itself in two almost equal parts.

Fig. 18A. A smaller, probably final sporoblast with nuclei in mitosis. The nuclei are yet connected by caryoplasm.

Fig. 18B. One of the cytospheres of the former.

Fig. 19. A sporogonium of Spermatobium eclipidrili. The nuclei are well scattered out, but remains of nucleoli are seen in two places. The cytospheres have not yet collected into sporoblasts.

Fig. 20A. A similar sporogonium of Spermatobium Freundi at the same stage of development, Figs. 19 and 20, are drawn under the same magnification and show the relative size of the sporogonia and cytospheres in the two species of Spermatobium.

Fig. 20B. A group of cytospheres.

Fig. 20C. A cytosphere drawn on a larger scale, both from the sporogonium figured in fig. 20.

Fig. 21A. A sporogonium in which some of the micronuclei are unusually small, by an error of engraver not shown.

Fig. 21B. A sporoblast of the same with five micronuclei.

Fig. 22. A sporoblast with dividing nuclei. These sporoblasts would have further divided.

Fig. 23. A remaining nucleolus, showing a spherical granulation, surrounded by cytospheres. The macronucleus has entirely disappeared.

Fig. 24. A sporogonium with partly developed lunate spores.

Fig. 25. Some of the spores drawn on a larger scale.

Fig. 26. A shuttle spore with nuclear or nucleolar bodies.

Fig. 27. A fully developed pseudonavicella spore with beaded margin, nucleus and cytospheres.

Fig. 28. An empty spore of unusual form.

Fig. 29. A sporogonium with spores in various stages of development. A central "restkörper" of unused cytospheres.

Fig. 29B. A sporogonium with shuttle spores and "restkörper."

Fig. 30. Another sporogonium with shuttle spores. The restkörper is scattered and divided.

Fig. 31. A sporogonium with multinucleated shuttle spores.

Fig. 32. Some of the spores more highly magnified. Zeiss 1-12, oc. 4.

Fig. 33. Lunate spore from Spermatobium eclipidrili.

Fig. 34. A shuttle spore from Spermatobium Freundi. The two smaller figures, A and B, represent the cytospheres, respectively from figs. 33 and 34, showing their relative size.

Fig. 35. A shuttle spore from Spermatobium Freundi, showing amœboid movement.

Fig. 36. A sporogonium just bursting, with fully nucleated shuttle spores.

Fig. 37. Two of the spores drawn on a larger scale.

Fig. 38. A Spermatobium eclipidrili, in division, with three nuclei. Between *a b c* the division lines are seen.

Fig. 39. A Spermatobium Freundi in division. The nuclei are already formed, the remaining nucleoli in division.

Fig. 40. A Spermatobium in division. Micronuclei are formed and nucleoli dispersed.

Fig. 41A, B, C. A divided Spermatobium with perfect nuclei, but not fully developed cytospheres. In 41A the focus is set on the vacuoles.

" B. Similarly focused on the surface cytospheres.

" C. Focused on the nuclei.

" D. A nucleus more magnified.

Fig. 42. A Spermatobium eclipidrili in division. In the smaller sporogonia the sporoblasts are already formed, while in the one to the left the cytospheres are yet diffused. The micronuclei in position.

Fig 43 A Spermatobium of unusual size and structure.

Fig. 44. A Spermatobium of similar shape enclosed in a thick cyst. Pos-

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CATALOGUE OF MARINE SHELLS, COLLECTED CHIEFLY ON THE EASTERN SHORE OF LOWER CALIFORNIA FOR THE CALIFORNIA ACADEMY OF SCIENCES DURING 1891–2.

The Gulf of California is the richest field for molluscan collections outside of the tropics along the whole west American coast, principally for the reason that, being nearly landlocked and opening only southward, it is almost as tropical as the more southern waters toward the Equator, and perhaps even warmer than some regions where currents from the north have free circulation. The contrast is thus strongly shown between the gulf and the western coast of the peninsula, in the small proportion of tropical species found on the latter and their more limited range northward.

The length of the gulf is about 760 miles northward of the latitude of Cape St. Lucas (22° 52′), and of this only forty-four miles are south of the Tropic of Cancer, while the width averages about fifty miles. The influx of the Colorado and other smaller rivers serves to keep the water from becoming too salt for molluscan life, and, though during Captain Beechey's voyage of discovery in the "Blossom," and published in London, 1839, in which twenty species from the gulf are mentioned, mostly new ones. These were chiefly shore shells and showy species. In 1836–1842 Captain Belcher, with the British ship "Sulphur," surveyed that coast, and the ship's surgeon, Richard B. Hinds, made some more thorough collections, partly by dredging, obtaining about thirty species, most of them published in the "Zoology of the Sulphur," 1836 to 1842.

The next important collections were made during the Mexican war by the American, Col. E. Jewett, traveling at his own expense. He touched at Mazatlan, and obtained six species, supposed to be from there, but probably many more were mixed with the shells collected by Major Rich, U. S. A., numbering 108 species, and 102 obtained by Lieutenant Green, U. S. N., in the gulf. These were catalogued by Dr. A. A. Gould, and about thirty supposed new species described by him as [new] "Mexican and Californian Shells," with figures, in the Boston Journal of Nat. Hist., vol. vi, 1853.

The most extensive collection ever made in the gulf was by Fred. Reigen at Mazatlan, which place, being only about twenty-five miles north of the latitude of Cape St. Lucas and close to the Tropic of Cancer, shows most perfectly the influence of a tropical climate on the mollusca. A special work on this collection of about 708 species, and also on all others then known from Mazatlan, was published by P. P. Carpenter, as the "Mazatlan Catalogue," 1855–7. The collection was the result of three years' work, and contained a few species that may have been imported on ships.

The Xantus collection, made at Cape St. Lucas, has been before mentioned, in the first article on land shells collected by Mr. W. E. Bryant, in these Proceedings, 1891, p. 100. In eighteen months Xantus obtained 361 marine species, some of them probably from the Socorro Islands and the coast of Mexico, and about sixty of them were described by Carpenter as new. He states that "Pacific [Polynesian] shells may have been given to Xantus by sailors; they were not distinguished from his own series in opening the packages." A larger proportion of Panama species were found than at Mazatlan by Reigen.

The next marine collections known from the gulf and also west of the peninsula are those mentioned in a paper by R. E. C. Stearns on "The Shells of the Tres Marias Islands and other localities along the shores of Lower California and the Gulf of California" (from the Proceedings of the U. S. National Museum, vol. xvii, pp. 134–204, 1894). The islands named are over 100 miles southeast of the gulf, and therefore have no relation to the present subject, except that many of the species reach the gulf (about fifty-eight out of eighty-nine). Out of 294 in the catalogue, about 200 occur in the gulf, and includes those contributed by ten other persons, who collected small numbers from both coasts of the peninsula and the main Mexican shores.

It thus appears that there are known about 700 to 800 species of mollusca from near the entrance of the gulf, and even there very little thorough work in collecting has been done and most of the shells obtained have been dead ones more or less imperfect.

From small collections hitherto made in the northern end of the gulf, quoted by Carpenter or Stearns, it appears that the species found there are more largely of the temperate fauna, many of them being identical with those from the same latitude on the west coast of the peninsula. This seems to indicate that the dividing ridge, now 3,000 feet or more in altitude, was crossed by one or more channels within geologically recent times.

The parties collecting for the Academy in 1891–2 were not well prepared for obtaining marine mollusca, being engaged chiefly in collecting vertebrate animals, insects and plants, on the peninsula and nearest islands, though also preserving such land shells as they met with, when not too busy otherwise. Mr. W. E. Bryant, being often on the seashore in pursuit of vertebrate animals, spent some time in collecting the shells along the beaches, living or dead, and when La Paz was reached, continued their pursuit onto Espiritu Santo and San José islands lying nearly in a line northward from that place, and each about fifteen to twenty miles long. The latter, crossed midway by the 25th parallel of latitude, proved to be the most productive of species of any point visited north of Cape St. Lucas, nearly 150 miles to the south. Besides a large number of beach shells perfect enough for identification, many were obtained in excellent condition through the aid of native divers, who not only dive for pearls, but will find other shells for money and collect many of the larger kinds for food, eating nearly every large mollusc that is tender and well flavored. The collections were thus made chiefly at San José del Cabo, twelve miles east of Cape St. Lucas, at La Paz and at San José Island. Mr. Brandegee and Dr. Eisen also contributed several species from the same places. These places are near enough to the locality of the Xantus collection to be considered as belonging to the same local fauna, yet several species occurred that are new to the region. As almost every collection of shells, however small and imperfect, adds some new facts to our knowledge of geographical distribution, a list of these is thought to be worthy of publication. Some of the doubtful forms were sent to Dr. Dall of the U. S. National Museum for comparison with authentic specimens and are given as identified by him. Duplicates of many of the shells (and also of many others, native and foreign) are ready for exchange, in return for species not contained in the Academy's museum, or not in good condition.

CLASS GASTROPODA—UNIVALVES, ETC.

9. Astralium unguis Wood. 2, young. Also Cape St. Lucas.
10. Bulla adamsi Menke. 28. Many approach *nebulosa*.
11. Cassis coarctatus Gray. 5, good examples; common south.
12. Cassis sulcosa Bruguiere, var. *abbreviata* Lamk. 3, good.
13. Cassis tenuis Gray. 2, fresh examples. Perhaps imported.
14. Cerithium adustum Kiener. 35, common; living.
15. Cerithium gemmatum Hinds. 100, common; living.
16. Cerithium incisum Sowerby. 200, common; living.
17. Cerithium interruptum Menke. 2, San José del Cabo.
18. Cerithium ocellatum Bruguiere. 150, mostly La Paz.
19. Chlorostoma coronulatum C. B. Adams. A pint of beach shells.
20. Columbella cribraria Lamarck. Common on algæ.
21. Columbella fuscata Sowerby. San José del Cabo. Common.
22. Conus brunneus Wood. 30, beach shells; many perfect.
23. Conus princeps Linné. 32, many fine specimens.
24. Conus puncticulatus Hwass. 6, beach.
25. Conus purpurascens Broderip. 14, many very perfect.
26. Coralliophila nux Reeve. 1, San José del Cabo.
27. Crepidula aculeata Gmelin. 6.
28. Crepidula onyx Sowerby. Many small specimens.

29. **Crucibulum scutellatum** Gray. A pint or more.
30. **Crucibulum tubiferum** Lesson. A pint or more.
31. **Cypræa albuginosa** Mawe. 10, also San José del Cabo; good.
32. **Cypræa arabicula** Lamarck. 8, some good.
33. **Cypræa pustulata** Swainson. San José del Cabo.
34. **Cypræa sowerbii** Gray. 30, mostly beach-worn.
35. **Drillia aterrima** Sowerby. 2, beach shells.
36. **Drillia maura** Kiener. 1, west coast of Lower California.
37. **Erato maugeriæ** Gray. 1, also Cape St. Lucas. West Indies.
38. **Engina reevei** Tryon. 12, beach shells.
39. **Eupleura muriciformis** Broderip. 3, young; living.
40. **Euryta aciculata** Lamarck. San José del Cabo.
41. **Fasciolaria princeps** Lamarck. 10, eaten by natives.
42. **Fissurella rugosa** Sowerby. 1, known before from the gulf.
43. **Fissurella virescens** Sowerby. 7, known before

50. LATIRUS GRACILIS Reeve. 2, beach-worn examples.

51. LEPIDOPLEURUS (probably *L. pectinulatus* Carp.) 1.

52. LITTORINA ASPERA Philippi. Abundant; several varieties.

53. MALEA RINGENS Swainson. 20, eaten by natives.

54. MELAMPUS OLIVACEUS Carpenter. 2, beach shells.

55. MELONGENA (SOLENOSTEIRA) MODIFICATA Reeve. 6. This much discussed shell seems to belong chiefly to this region.

56. MITRA MAURA Swainson. 1, a wide-spread species.

57. MITRA TRISTIS Sowerby. 1, a finely colored example.

58. MODULUS CERODES A. Adams. Half-pint of good specimens.

59. MURICIDEA DUBIA Sowerby. 8, chiefly beach shells.

60. MUREX BICOLOR Valenciennes. 5, perhaps *brassica lamarck*.

61. MUREX PLICATUS Sowerby. 4, in good condition.

62. MUREX RADIX Gmelin. 4. This and *bicolor* are eaten.

63. NASSA TEGULA Reeve. 2, more common northward.

64. NASSA VERSICOLOR C. B. Adams. 70, also Mazatlan (Reigen).

65. NATICA BIFASCIATA Recluz. 45, common beach shells.

66. NATICA GLAUCA Humboldt. 2, also Mazatlan (Reigen).

67. NATICA MAROCHIENSIS Gmelin. 1, at La Paz only.

68. NATICA UBER Valenciennes. 13, common beach shells.

69. NERITA BERNHARDI Gmelin. 25, common at low water.

70. NERITA SCABRICOSTA Lamarck. 50, common at low water.

71. NERITINA PICTA Broderip. 25, San José del Cabo only.

72. NERITINA CALIFORNICA Reeve. Same place, in creek.

73. NUTTALINA SCABRA Reeve. 1, a dry beach specimen.

74. OLIVA ARANEOSA Lamarck. 15, mostly beach-worn.

75. OLIVA PORPHYRIA Linné. 15, fresh specimens.

76. OLIVELLA DAMA Duclos. 150, common at low water.

77. OLIVELLA MYRIADINA Duclos. 45, called "rice shell."

78. ONISCIDIA TUBERCULOSA Reeve. 2, good specimens.

79. OPALIA CRENATOIDES Carpenter. 1, a rare species.

80. PLEUROTOMA NOBILIS Hinds. 1, a fresh specimen.

81. PLEUROTOMA OLIVACEA Sowerby. Several, beach-worn.

82. POTAMIDES MONTAGNEI Orbigny. 2, rare in the gulf.

83. PURPURA BISERIATA Blainville. 8, living at low water.

92. SOLARIUM GRANULATUM Lamarck. 2, beach shells.
93. STROMBINA ANGULOSA Sowerby. 20, San José del Cabo.
94. STROMBINA MACULOSA Sowerby. 50, mostly from San José del Cabo.
95. STROMBUS GALEATUS Swainson. 10, eaten by natives.
96. STROMBUS GRACILIOR Sowerby. Several beach shells.
97. STROMBUS GRANULATUS Lamarck. 100, beach shells.
98. TEREBRA LINGUALIS Hinds. 1, also Cape St. Lucas (Xantus).
99. TEREBRA VARIEGATA Gray. 3, beach specimens only.
100. TORNATINA CULCITELLA Gould. 1, more common in California.
101. TRITONIUM GIBBOSUM Broderip. 5, young specimens.
102. TRITONIUM VESTITUM Hinds. 1, rare in the gulf.
103. TRIVIA PACIFICA Gray. 1, rare in the gulf.
104. TRIVIA SANGUINEA Gray. 12, common at low tide.
105. TRIVIA SOLANDRI Sowerby. 100, common at low tide.
106. TURBO FLUCTUOSUS Wood. 20, common at low tide on algæ.
107. TURRITELLA SANGUINEA Reeve. 2, a variety of next?
108. TURRITELLA TIGRINA Kiener. 12, *T. goniostoma* Valenc.?
109. VERMETUS CENTIQUADRUS Valenciennes. 15, very variable.
110. VOLUTA CUMINGI Broderip. 3, also var. *pederseni* Verrill, 1.

111. VOLVARINA VARIA Sowerby. 1, *Marginella varia* (Tryon).

CLASS PELECYPODA—BIVALVES.

112. ANOMIA LAMPE Gray. Valves common; none entire.

113. ARCA GRANDIS Broderip. 10 valves; 3 young entire.

114. ARCA MULTICOSTATA Sowerby. 4 valves; 3 young entire.

115. ARCA PACIFICA Sowerby. Several valves and 3 large fresh examples.

116. ARCA TUBERCULOSA Sowerby. Several middle sized examples.

117. AVICULA PERUVIANA Reeve. Common and very large.

118. AXINÆA GIGANTEA Reeve. 12 valves; eaten by natives.

119. BARBATIA FUSCA Bruguiere? A few, perhaps *B. solida* Sby.

120. BARBATIA GRADATA Broderip. A few beach-worn valves.

127. Cardium consors Broderip. 1 valve, San José del Cabo.
128. Cardium procerum Sowerby. Valves only.
129. Cardium senticosum Sowerby. Valves only.
130. Chama echinata Broderip. Valves, and entire young.
131. Chama exogyra Conrad. A few seen of this form.
132. Chama frondosa Broderip. 4, the most common form.
133. Clidiophora punctata Conrad. Two flat valves, beach.
134. Chione pulicaria Sowerby. 30, probably a variety of next.
135. Chione succincta Valenciennes. 20, common, eatable.
136. Chione undatella Sowerby. 30, common variety ? of the last.
137. Codakia tigrina Linné. Many fresh ones, eatable.
138. Crassatella gibbosa Sowerby. A few, large and small.
139. Diplodonta semiaspera Philippi. 1 valve, San José del Cabo.
140. Donax californicus Conrad. 2 valves.
141. Dosinia ponderosa Gray. A few small ones and valves.
142. Hemicardium biangulatum Sowerby. Small ones; rare.
143. Heterodonax bimaculatus. 50 valves, scarcely two alike.
144. Kellia suborbicularis Montagu. 5 specimens.
145. Labiosa undulata Conrad. 2 valves.
146. Lima squamosa Lamarck. Some entire, valves common.

147. Liocardium apicinum Carpenter. Many valves, 30 entire.

148. Liocardium elatum Sowerby. A few valves.

149. Lithophagus plumula Hanley. Burrowing in spondylus, etc.

150. Lucina eburnea Reeve. 30 valves, San José del Cabo.

151. Lucina excavata Carpenter. Valves, very near *L. nuttalli.*

152. Lucina pectinata Carpenter. 4 valves. This and last also found at Mazatlan.

153. Lucina undata Carpenter. 3, common in the gulf.

154. Macoma ochracea Carpenter. A few valves. (Dall identified.)

155. Mactra dolabriformis Conrad. A few valves. (Dall identified.)

156. Margaritiphora fimbriata Dunker. 30, pearl shells; animal, eatable.

157. Modiola capax Gould. 10, entire; many valves.

158. Mytilus multiformis Carpenter. 2, San José del Cabo only.

166. PECTUNCULUS MULTICOSTATUS Sowerby. Small but perfect examples.
167. PERIPLOMA PLANIUSCULA Sowerby. Valves, same as *P. argentaria* Con.
168. PERNA CHEMNITZIANA Orbigny. Valves, and some perfect examples.
169. PINNA LANCEOLATA Sowerby. Several specimens.
170. PINNA MAURA Sowerby. A few specimens.
171. PLACUNANOMIA CUMINGI Broderip. Only 1 valve.
172. PLACUNANOMIA MACROCHISMA Deshayes. Common.
173. SANGUINOLARIA MINIATA Gould. 2, entire shells.
174. SANGUINOLARIA NUTTALLI Conrad. A few valves.
175. SEMELE BICOLOR C. B. Adams. 1 entire, 2 valves. (Dall identified.)
176. SEMELE FLAVESCENS Gould. 10 valves.
177. SEMELE VENUSTA A. Adams. 2 entire shells.
178. SPONDYLUS CALCIFER Carpenter. Living, very massive.
179. SPONDYLUS LIMBATUS Sowerby. 7 living. All spondyli are used as food.
180. SPONDYLUS PRINCEPS Broderip. Living.
181. STRIGILLA CARNARIA Linné. Valves, common on beach.
182. STRIGILLA LENTICULA Philippi. San José del Cabo.
183. TELLINA INTERRUPTA Wood. Several whole shells and valves.
184. TELLINA PURA Gould. 6 valves.
185. TELLINA PURPUREA Broderip. 1 valve, San José del Cabo.
186. TEREBRA LUCTUOSA Hinds. 1, San Jose del Cabo.
187. TIVELA RADIATA Sowerby. Several good specimens.

188. TIVELA ELEGANS Verrill. Several valves.

189. THRACIA CURTA Conrad. 1 specimen (Dall ident.)

190. VENUS SUBIMBRICATA Sowerby. Valves (S. G. Anomalocardia).

191. VOLA DENTATA Sowerby. Valves; common, eatable.

NOTE.—In the late "Catalogue of Shells in the Museum of the Academy," etc., including the geographical distribution of species known from Sitka to Cape St. Lucas, many are given as from "West Coast, lat. 26°," and southward. These were collected by the late Dr. Gabb at San Juanico on the west coast of the peninsula, but the locality having been confused with one on the east side, in the gulf, at about the same latitude, it was uncertain which coast they were from. In his late paper Dr. Stearns credits them all to the west coast. (See "Zoe" for April, 1892.)

NOTES ON A SPECIMEN OF ALEPISAURUS ÆSCULAPIUS BEAN, FROM THE COAST OF SAN LUIS OBISPO COUNTY, CALIFORNIA.

BY FLORA HARTLEY.

[With Plate ii.]

The valuable specimen here described and figured was found on the coast of San Luis Obispo county, Cal., by W. P. Stevens, on September 19, 1894, having been thrown on the beach by the waves. It was presented by Mr. Stevens to the California Academy of Sciences. The specimen agrees in most particulars with Dr. Bean's original description of *Alepidosaurus æsculapius* (Proc. U. S. Nat. Mus. 1882, p. 661). The following descriptive notes contain the principal points wherein our specimen differs from the type, and present some additional details:

Head in body 5¼ times; width of head in length of head 4; height of head in length of head a little over 2; eye in head 6; interorbital area wider than diameter of eye; eye in snout 2½. Top of head with two prominent, sharp, bony ridges, that run from the tip of the snout to behind the eye. On the parietals striæ radiate from this ridge toward the median line and outward toward the eye. Just behind the orbit, and parallel with it, is a series of six small blunt spines.

Opercle with strong striæ radiating from the upper anterior angle; subopercle nearly as large as opercle and strongly striate, the striæ radiating from the anterior lower articulation; a thin membrane connects the opercle and subopercle; mandible with strong longitudinal striations and many mucous pores.

Outer row of teeth in upper jaw short and very sharp, increasing in length anteriorly. No teeth in the extreme front of upper jaw, but two small decurved teeth on each side of tip of jaw. Palatine teeth arranged in three groups.

In front are two very large compressed teeth on each side, 1½ inches long, behind which is a naked space 1¼ inches long; this is followed by three teeth ⅝ inches long, and finally eight short knife-like teeth. Lower jaw with symphysis bare, a bifid tooth-like spine on each side of it. Behind this come two long thorn-like teeth, the first ⅓ in. long, the second ½ in., followed by 15 short knife-like teeth. The teeth are all very sharp and directed backward and so long that the mouth cannot be completely closed. Upper pharyngeal teeth long and slender; upper pharyngeals formed by the coalesced parts of the 2, 3 and 4 pharyngobranchials.

Gill-rakers long, sharp and toothlike, bifid or trifid; on the anterior part of the lower gill-arches they appear as teeth where the arches join the hyoid. Upper lobe of caudal evidently not prolonged into a filament; middle rays longer than the height of the tail.

D 39, P 15, A 17, V 9, B 7. Length of specimen, 52¼ inches.

The type of this description is in the museum of the California Academy of Sciences. It is in good condition,

DESCRIPTION OF A NEW JACK-RABBIT FROM SAN PEDRO MARTIR MOUNTAIN, LOWER CALIFORNIA.

BY JOHN M. STOWELL.

[With Plate iii.]

Lepus martirensis sp. nov.

Type, ad. ♂ No. 748, Museum Leland Stanford Junior University; La Grulla, San Pedro Martir Mountains, Lower California, June 30, 1893. Collectors, John M. Stowell and Samuel C. Lunt.

Total length 603; tail vertebræ 95; hind foot 126; ear, from crown, 184.

Cranial Measurements.

Collection number.	Basilar length.	Total length.	Greatest breadth.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors, from front to molars.	Upper incisors, from front to hinder margin of palate.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Upper molars, distance between.	Lower jaw, length.	Lower jaw, height.
748	79.5	101	42.	29	41.	20	14.5	31.5	40.2	10.7	9.	17.5	13.	?	41.
749	79.5	99	42.5	29	37.	21	13.	31.5	41.	11.	8.5	17.5	12.5	72	42.
750	76.	95	42.	26	38.7	19	12.	31.7	41.	11.	9.	17.	11.5	71	43.5

About the size of *Lepus californicus*, but with much larger ears and darker coloration.

Color above, steel gray, strongly mixed with black, without the rufous tinge of *L. californicus*. Sides lighter, with traces of rufous. Chin and throat yellowish white. Under side of neck same color as sides, a black tip and a subterminal white zone on the longer hairs giving a decided gray tinge. Breast and inner side of legs salmon color, not cinnamon as in *L. californicus*. Belly whitish, but strongly washed with light salmon. A white patch between hind legs. The tail darker on lower side than in *L. californicus*.

The ears are sparsely haired and the hair is very short, in this respect much like *L. alleni*. The fringe on the anterior edge is dark gray, short and fine in texture. The tips of ears are black, the black extending down the posterior edge of the convex side for nearly one-half its length.

This species is based upon three specimens, all fully adult, collected by Samuel C. Lunt and John M. Stowell during June and July, 1893, in the San Pedro Martir Mountains, Lower California, at an altitude of about 7,000 or 8,000 feet.

Four other specimens were seen by the party but not secured, all in the vicinity of La Grulla, a large timber-inclosed meadow-tract, watered by mountain streams. Tracks were seen in several other places upon the mountains, but we did not start the animals from their hiding places and concluded that they must secrete themselves in the crevices among the huge rocks which are heaped up so numerously.

The San Pedro Martir Mountains form a range about 70 miles in length, their eastern slope passing into the

A SUPPLEMENT TO THE BIBLIOGRAPHY OF THE PALÆOZOIC CRUSTACEA.*

BY ANTHONY W. VOGDES.

In offering this supplement to the literature of this special subject the author has brought the catalogue up to date, as far as lies within his knowledge, and corrected some errors and omissions of the first edition.

A few may ask, what is the advantage of such a catalogue; but let them take up any special study, and the first thing that is wanted is a list of books, to know how and what to read.

Such compilations are dry and laborious, but like all things that lead to, or add to knowledge, we have to dig through a mass of details.

The palæontologist has to work with species and all such lists save him many a weary day of research through many pamphlets and books; then again the want of just such a catalogue as is herewith presented to the Academy leads to the making of new species, from which we pray to be delivered. These hastily made children retard the progress of knowledge, and sooner or later will have to be reclassified under some older name, delaying the progress of an advancing science, taking up the time and labor of the student, to say nothing of his temper.

Agassiz (L.) The Trilobites.
In Canadian Nat. Geol., vol. 6, 1872, pp. 358-361.

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In Zeitsch. Ges. für Erdkunde, Berlin, vol. 28, 1893; No. 5, p. 352.
Phacops brasiliensis Clarke. *Harpes* sp.

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*Occasional Papers of the California Academy of Sciences, No. iv, 1893.

Andersson (J. G.) Note on the Occurrence of the Paradoxides ölandicus zone in Nerike.

In Bull. Geol. Inst., Upsala, vol. 1, 1892, No. 1.

——— Ueber Blöcke aus dem jüngerex Untersilur auf der Insel Oland vorkommend.

In Kongl. Svenska Vetenskaps-Akad., Förhandlingar, No. 8, 1893, p. 521.

Trinucleus seticornis His.

——— Ueber das Alter der *Isochilina canaliculata* Fauna.

In Ofversigt af Kongl. Vetenskaps-Akad., Förhandlingar, 1893, No. 2, p. 125.

Isochilina canaliculata Kr. *Primitia distans* Kr. *P. plana* var. *tuberculata* Kr. *P. plicata* Kr. *Entomis (Primitia?) flabellifera* Kr. *E. quadrispina* Kr.? *E. obliqua* Kr. *Primitia auricularis* Kr. *Entomis (Bursulella?) quadrispina* Kr. *Bollia minor* Kr. *B. major* Kr. *Tetradella harpa* Kr. var. *T. carinata* Kr. *T. rostrata* Kr. *T. erratica* Kr. var. *Ctenobolbina ciliata* Emmons? *Beyrichia radians* Kr. *B. (Ulrichia?) bidens* Kr.

Armstrong (J.), **Young** (J.) and **Robertson** (D.) Catalogue of Western Scottish Fossils, with introduction on the Geology and Palæontology of the District by John Young. Glasgow, 1876.

Aurivillius (C. W. S.) Ueber einige obersilurische

Beecher (C. E.) A larval form of *Triarthrus*.
In Am. Jour. Sci., 3d series, vol. 46, 1893, p. 361, also p. 469, woodcut.
Triarthrus beckii Green.

——— On the mode of occurrence and the structure and development of *Triarthrus beckii*.
In The American Geologist, vol. 13, 1894, pp. 38-43, plate.
Triarthrus beckii Green.
Abstract of a paper read before Nat. Acad. Sci., Nov. 8, 1893.

——— Larval forms of Trilobites from the Lower Helderberg Group.
In Am. Jour. Sci., 3d series, vol. 46, 1893, p. 142, plate.
The author illustrated the larval forms of *Acidaspis tuberculatus* Conrad and *Phaëthonides* sp.?

——— The appendages of the pygidium of *Triarthrus*.
In Am. Jour. Sci., 3d series, vol. 47, 1894, pp. 298-300, plate vii.

——— On the mode of occurrence and the structure and development of *Triarthrus beckii*.
In the American Geol., vol. 13, 1894, pp. 38-43, plate iii.

——— Further observations on the ventral structure of *Triarthrus*.
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——— Structure and appendages of *Trinucleus*.
In Am. Jour. Sci., 3d series, vol. 49, 1895, pp. 307-311, plate iii.

Bennie (James). On the prevalence of Eurypterid remains in the Carboniferous shales of Scotland.
In Proc. Royal Phy. Soc. Edinburgh, vol. 9, 1885-88, p. 499.
Not descriptive.

Benshauser (L.) Ueber Hypostomen von *Homalonotus*.
In Jahrb. Königl. preuss. Geol. Landesanst. für 1891, pp. 154-166, 1892.

Bergeron (Jules). Étude paléontologique et stratigraphique des terrains anciens de la Montagne Noire.
In Bull. Soc. Géol. France, 3d series, vol. 15, 1887, No. 5, p. 376.
Harpes Escoti n. sp. *Cheirurus Lenoiri* n. sp. *Phacops Munieri* n. sp. *P. Rouvillei* n. sp.

——— Etude géologique du massif ancien situé au sud du Plateau central.

Paris 1889, pp. 1-361, plates i-ix.

Conocoryphe coronata Barr. *C. Rouayrouxi* M. C. et Berg. *C. Heberti* M. C. et Berg. *C. Levyi* M. C. et Berg. *Conocoryphe* sp.? *Paradoxides rugulosus* Corda. *Agnostus Sallesi* M. C. et Berg. *Asaphelina Barroisi* M. C. et Berg. *Megalaspis Filacovi* M. C. et Berg. *Calymene Filacovi* M. C. et Berg. *Agnostus Ferralsensis* M. C. et Berg. *Phacops Potieri* Bayle. *Harpes Escoti* J. Berg. *Cheirurus Lenoiri* J. Berg. *Phacops Munieri* J. Berg. *P. Rouvillei* J. Berg. *Bronteus Gouzesi* J. Berg.

Fig. 2*b*, plate v, represents the pygidium of a *Lichas* n. sp. and not a *Cheirurus*. The author mentions the following undescribed species: *Asaphus Fourneti* Vern., *A. Graffi* Vern., *Illænus Lebescontei* Trom.

——— Crustacés.

In L'Annuaire Géologique Universel Tome, viii, 1891.

A review of Matthews', Clarke's and Delgado's papers on Trilobites.

——— La Faune dite "Primodiale"; est-elle la plus ancienne?

In Revue Gen. des Sci. Dec., 1891-1892, pp. 1-24.

Figures *Paradoxides bohemicus* Bœck. *Calymene senaria* Conrad. *Sao hirsuta* Barr. *Olenellus gilberti* Wal. *Agnostus rex* Barr. *Paradoxides spinosus* Bœck. *Conocoryphe coronata* Barr.

——— Notes Paléontologique I. Crustacés.

In Bull. Gèol. Soc. France, 3d series, vol. 21, 1893, pp. 333-347, plates vii, viii.

nelidan ancestor which bent its mouth round ventrally so as to use its parapodia as jaws."

Beyrich (Ernst). Ueber eine Kohlenkalk-Fauna von Timor.

In Abhandl. d. k. Acad. Wissensch. zu Berlin, 1864, vol. 36, 1865.
Phillipsia parvula n. sp.

Bigot (A.) Note sur les *Homalonotus* des grès siluriens de Normandie.

In Bull. Soc. Géol. France, 3d series, vol. 16, 1888, p. 419, plates v–vii.
Homalonotus bonissenti Morière. *H. deslongchampsi* Trom. *H. brongniarti* Deloug. *H. serrata* Trom. *H. vicaryi* Salt. *H. besnevillensis* n. sp. *H. morieri* n. sp. *H. incertus* n. sp. *H. viellardi* Trom. *Plæsiacomia brevicaudata* Deloug.

Bolsche (W.) Ueber *Prestwichia rotundata* H. Woodward aus der Stein Kohlen formation der Piesberges bie Osnabrück.

In Jahr d. Naturn. Vereins zu Osnabrück.

Bolton (H.) On the occurrence of a Trilobite in the Skiddaw slates of the Isle of Man.

In Geol. Magazine, Decade 3, vol. 10, 1893, p. 29.
The author describes an imperfect specimen of the genus *Asaphus* or *Æglina*.

——— Catalogue of the types and figured specimens in the Geological Department of the Manchester Museum, Manchester, 1893, 35 pp.

Leaia Leidyi var. *Williamsoniana* Jones. *Carbonia Rœderiana* J. & K. *C. fabulina* J. & K. *C. Bairdoides* J. & K. *C. Salteriana* J. & K. *C. pungens* J. & K. *C. secans* J. & K. *Ceratiocaris minuta* J. & W. *Pygocephalus Cooperi* Huxley fig. *Hymenocaris vermicauda* Salter. *Cyclus Scotti* sp. nov. This article is by Henry Woodward. *Arionellus longicephalus* Hicks. *Niobe Menapiensis* Hicks. *N. Homfrayi* Salt. *Neseuretus Ramseyensis* Hicks. *N. quadratus* Hicks. *Neseuretus* sp. *N.* sp. *Phillipsia gemmulifera* Phillips. *Griffithides acanthiceps* H. W. *Eurypterus punctatus* Salt. *Pterygotus Lundensis* Salt. *P. Banksii* Salt. *Stylonurus megalops* Salt.

Brongniart (Charles). Note sur un nouveau genre d'Entomostracé fossile provenant du terrain Carbonifère des environs de St. Etienne.

In Annales Sci. Géol., vol. 7, 1876, plate vi.
Palæocypris edwardsii.

Burmeister (H.) Ueber *Gampsonychus fimbriatus* Jord.

In Abh. d. Naturfosch. Gesellschaft zu Halle, 1854, vol. 2, pp. 191-200, plate.

The author changes Jordon's generic name of *Gampsonyx* to *Gampsonychus*, the former having been used by Swainson for a genus of *Falconidæ*.

Clarke (J. M.) On the structure of the carapace in the Devonian Crustacean *Rhinocaris* and the relation of the genus to *Mesothyra* and the Phyllocaridæ.

In American Naturalist, Sept., 1893, p. 793.

The author places the genera *Mesothyra* and *Rhinocaris* under the Rhinocaridæ, remarking "that the two fossils are very closely related, and it will not do to separate them by more than a generic difference." He illustrates the carapace structure in *Rhinocaris*, *R. columbina*, *Mesothyra oceani*, *Hymenocaris vermicauda* and *Protocaris marshi*.

——— List of the original and illustrated specimens in the Palæontological Collections, Part 1, Crustacea.

In 11th Annual Report of the N. Y. State Geologist for the Year 1891, Albany, 1892.

The author gives a systematic classification of the fossil Crustacea.

See also 45th Report N. Y. State Museum for 1891.

——— On *Cordania*, a proposed new genus of Trilobites.

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Dalmanites achates Billings. *Pterygometopus intermedius* Wal. *P. eboraceus* n. sp. *P. schmidti* n. sp. *P. callicephalus* Hall. *Ceraurus pleurexanthemus* Gr. *Pseudosphœrexochus trentonensis* n. sp. *Cyrtometopus scofieldi. Encrinurus vannulus* n. sp. *E. raricostatus* Wal. *E. cristatus* n. sp. *Cybele winchelli* n. sp. *Odontopleura parvula* Wal. *Arges wesenbergensis* Schmidt var. *paulianus* n. var. *Platymetopus cucullus* M. & W. *P. robbinsi* Ulrich. *Proetus parviusculus* Hall *Harpina minnesotensis* n. sp. *Cyphaspis? galenensis* n. sp. *Proetus stonemani* Vogd.

Claypole (E. W.) Palæontological notes from Indianapolis.

In The American Geologist, vol. 6, 1890, p. 255.

Eurysoma n. g. *E. newtini* n. sp.

The term *Eurysoma* being preoccupied, the author changes the generic term to *Carcinosoma* in the same volume, p. 400.

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In the Am. Geologist, vol. 13, 1894, p. 77, plate iv.

Carcinosoma ingens n. sp.

Cole (G. A. J.) The story of Olenellus.

In Natural Science, London, vol. 1, July, 1892, pp. 340–346.

The author figures after Walcott. *Olenellus Thompsoni* Hall. *O. (Mesonacis) vermontana* Hall. *O. (Holmia) Kjerulfi* Linnarsson. This figure is taken from Holm. There are no detailed descriptions in this paper.

Cox (James C.) Note on the Moore Park Borings.

In Proc. Linn. Soc. N. S. Wales for 1880 (1881), vol. 5, part 3, p. 273.

Estheria coglani n. sp.

Delgado (J. F. N.) Fauna Silurica de Portugal. Descripcao de uma forma nova de Trilobite *Lichas (Uralichas) ribeiroi*.

In Comm. dos Trabalhos Geol. de Portugal, Lisboa, 1892, 16 pp. and 6 plates.

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Edwards (H. Milne). Des nouvelles rescherches de M. Walcott relatives a la structure des Trilobites suivi de quelques considérations sur l'interprétation des facts ainsi constatés.

In Ann. Sci. Naturelle, series 6, vol. 12, 1881, No. 3, 31 pages, plates x, xi, xii.

Etheridge (R.) The Geology of the northern part of the English Lake District, by J, Clifton Ward, with an appendix of new species of fossils by R. Etheridge.

In Mem. Geol. Survey England and Wales, London, 1876, 132 pp., 12 plates.

Niobe doveri n. sp. *Æglina* sp.? *Asaphus* sp.? *Cybele ovata* n. sp.

Etheridge (R. Junr.) A monograph of the Carboniferous and Permo-Carboniferous Invertebrata of New South Wales, Part 2, Echinodermata, Annelida and Crustacea.

In Mem. Geol. Sur. N. S. Wales Palæontology, No. 5, Sydney, 1893, 131 pages, plates xii–xxii.

Carbonia australis n. sp. *Entomis Jonesi* Dekon. *Bairdia affinis* Morris. *B. curtus* McCoy. *Phillipsia dubia* Eth. jr. *P. Woodwardi* Eth. jr. *P. grandis* Eth. jr. *Phillipsia* sp.? *Griffithides Sweeti* Eth. jr. *Griffithides* sp.?

——— The invertebrate fauna of the Hawkesbury-Wianamatta series (Beds above the productive Coal Measures) of New South Wales.

In Mem. Geol. Survey N. S. Wales Palæontology, No. 1, Sydney, 1888, 21 pages, 2 plates.

Estheria coglani Cox.

——— *Hymenocaris salteri* McCoy.

In Records Geol. Survey N. S. Wales, 1892, vol. 3, pt. 1, pp. 5–8,

Etheridge (R. Jr.) and **Jacks** (R. L.) The Geology and Palæontology of Queensland and New Guinea.

Pp. xxx and 768, 68 plates and Geol. map of Queensland, London, 1892.
Beyrichia varicosa Jones. *Phillipsia dubia* Ether. *P. woodwardi* Ether. Jr. *Phillipsia* sp.? *Griffithides seminiferus* Phill.

Etheridge (R. Jr.) and **Mitchell** (John) The Silurian Trilobites of New South Wales, with reference to those of other parts of Australia.

In Proc. Linn. Soc. N. S. Wales, vol. 8, 1893, p. 169, plates vi-vii, pt. 2.
The genera *Proetus* and *Cyphaspis*. *Cyphaspis browningensis* Mitch. *C. yassensis* n. sp. *C. horani* n. sp. *C. rotunda* n. sp.

Feistmantel (O.) Ueber den Nürschener Gasschiefer dessen geologische Stellung und organische Einschlüsse.

In Zeitsch. deutsch. geol. Gesellschaft, vol. 25, 1873, p. 593, pl. xviii.
Gampsonychus fimbriatus Jordon.

Fraipont (Julien). Euryptérides nouveau du Dévonien Supèrieur de Belgique.

In Ann. Soc. Geol. de Belgique, vol. 17, 1889, p. 53, plate.
Eurypterus Lohesti Dewalque. *E.? dewalquei* n. sp.

Geinitz (H. B.) Ueber *Arthopleura armata* Jordòn in der Steinkohlen Formation von Zwickau.

In N. Jahrb. Min. Geol. Jahrgang 1866, p. 144, pl. iii.

——— Dyas oder die zechsteinformation und das Rothliegende, 1861.

The author refigures *Hemitrochiscus paradoxus* Schaur, and referred it to the Decapoda. He also describes *Palæocrangon (Prosoponiscus) problematicus* Schaur, and refers it to the Isopoda. He adopted *Prosoponiscus* Kirkby in preference to *Palæocrangon* Salter, remarking that *Palæosphæroma* would have been a more appropriate name than either of the foregoing.

Gurich (G.) Ueber eine cambrische Fauna von Sandomir in Russisch-Polen.

In Neues Jahrb. Mineralogie, 1892, Bd. 1, p. 69.
Agnostus fallax Linn. *A. gibbus* Linn. *Agnostus* sp. *Liostracus Linnarssoni* Brögg. *Paradoxides* cf. *tessini* Brongn.

——— Ueber eine Cambrische Trilobiten Fauna bei Sandomir.

In J. Ber. Schles Gesellsch., No. 69, 1891, p. 55.

Hector (James). On a new Trilobite *(Homalonotus expansus).*

In Trans. New Zealand Inst., vol. 9, 1876, p. 602, plate xxvii.

Hicks (H.) The Fauna of the Olenellus zone in Wales.

In Geol. Magazine Decade 3, vol. 9, 1892, p. 21.

The author refers *Leperditia? cambrensis*, described in Quart. Journal, 1871, to the head of an *Olenellus.*

Huxley (T. H.) Description of a new Crustacean *(Pygocephalus cooperi* Huxley) from the Coal Measures.

In Quart. Jour. Geol. Soc., vol. 13, 1857, p. 363, plate xiii.

——— On a stalk-eyed Crustacean from the Carboniferous Strata near Paisley.

In Quart. Jour. Geol. Soc., vol. 18, 1862, p. 420.

Pygocephalus cooperi Huxley.

Jones (T. Rupert) Notes on the Palæozoic Bivalved Entomostraca, No. xxix.

In Annals Mag. Nat. Hist., 6th series, vol. 6, 1890, pp. 317–324, plate xi.

Entomis serratostriata Sandb. *E. Richteri* n. sp. *E. gyrata* Richter. *E. variostriata* Clarke.

——— Notes on the Palæozoic Bivalved Entomostraca, No. xxx.

T. Wiltshire, Dr. H. Woodward and Prof. T. Rupert Jones (secretary).

In Brit. Assoc. Adv. Sci., 1892, 62d Meeting, pp. 298–300.

The genera here treated of are: *Hymenocaris*, *Lingulocaris*, *Saccocaris*, *Caryocaris*, *Aptychopsis*, *Peltocaris*, *Pinnocaris* and *Discinocaris*.

——— Fossil Phyllopoda of the Palæozoic Rocks. Tenth Report of the Committee, consisting of Prof. T. Wiltshire, Dr. H. Woodward and Prof. T. Rupert Jones (secretary).

In Brit. Assoc. Adv. Sci., 1893, 63d Meeting, pp. 455–470, plate i.

Phyllocarida. *Estheriæ*. *E. striata* Münster var. *Muensteriana* n. var. *E. Reinachei* n. sp. *E. Geinitzii* n. sp. *E.* var. *Grebeana* n. var. *Anomalocaris*. *Caryocaris Salteri*. *Aptychopsis anatina* Salt. and *Peltocaris Marrii* n. sp. *Hymenocaris vermicauda* Salt. *Lingularocaris siliquiformis* Jones.

——— Fossil Phyllopoda of the Palæozoic Rocks. Eleventh Report of the Committee, consisting of Prof. T. Wiltshire (chairman), Dr. H. Woodward and Prof. T. Rupert Jones (secretary). Drawn up by Prof. T. Rupert Jones.

In Brist. Assoc. Adv. Sci., 64th Meeting, August, 1894, pp. 271-272.

Elynocaris Hindii n. sp. *Discinocaris* and *Aptychopsis*, *Macrocaris Gorbyi*. *Estheria* sp.? *E. Dawsonsi* from Nova Scotia.

Jones (T. Rupert) and **Woodward** (Henry). A monograph of the British Palæozoic Phyllopoda (*Phyllocarida* Packard), part 2. Some bivalved and univalved species, pp. 73–124, plates xiii–xxvii.

Palæontological Soc. London, 1892.

Hymenocaris vermicauda Salt. *H.? lata* Salt. *Lingulocaris lingulæcomes* Salt. *L. siliquiformis* Jones. *L. salteriana* J. & W. *Lingulocaris* sp. *Saccocaris major* Salt. *S. minor* J. & W. *Caryocaris wrightii* Salt. *C. marrii* Hicks. *C.? salteri* McCoy. *Aptychopsis prima* Barr. *A. barrandeana* n. sp.; also var. *brevior*. *A. anatina* Salt. (corrected by authors, not *A. cordiformis* n. sp.) *A. lata* n. sp. *A. glabra* H. W. *A. wilsoni* H. W. *A. lapworthi* H. W. *A. ovata* n. sp. *A. salteri* H. W. *A. subquadrata* n. sp. *A. angulata* Baily. *A. oblata* n. sp. *Peltocaris aptychoides* Salt. *P. marrii* n. sp. (corrected by author, not *P. anatina* Salt.) *P. patula* n. sp. *P. carruthersii* n. sp. *P.? harknessii* Salt. *Pinnocaris lapworthi* R. Eth., jr. *Discinocaris browniana* H. W. *D. ovalis* n. sp. *D. undulata* n. sp. *D. gigus* H. W. *Ceratiocaris? Caryocaris?*

——— On some Palæozoic Phyllopodous and other fossils.

In Geol. Magazine Decade 3, vol. 10, 1893, p. 198, plate

Peltocaris Salteriana n. sp. *Dipterocaris Etheridge* J. & W. Fragments of a *Phyllocarid?* *Aptychopsis Williamsii* n. sp. *Ceratiocaris insperata* Salt.

——— On some Scandinavian Phyllocaridæ.

In Geol. Mag., new series, decade 3, vol. 5. London, 1888, pp. 145–150, plate vi.

Ceratiocaris Scharyi Barr. *C. pectinata* J. & W. *Phasganocaris pugio* (Barr.) var. *serrata* J, & W. *Ceratiocaris Angelini* J. & W.

Kiesow (J.) Die Cœlosphæridiengesteine und Backsteinkalke des westpreussischen Diluviums, ihre Versteinerungen und ihr geologisches Alter.

In Schriften d. Naturf Gesellsch. zu Danzig N. F. viii, vol. 3, 1893, 30 pp., 2 plates.

Entomis sigma Kr. *Beyrichia* sp. *B. marchica* var. *lata* Kr. *Lichas angusta* Beyr. *Cheirurus (Nieszkowskia) cephaloceras* Nieszkowski aff. *Phacops (Pterygometopus) lævigata* Schm. *Chasmops odeni* Eichw. *C. marginata* Schm. *C. macroura* Sjögren. *Chasmops* sp. *Asaphus (Isotelus)* sp. *Illænus roemeri* Volb. *I. gigas* Holm. *I. angustifrons* Holm.

——— Beitrag zur Kenntniss der in westpreussischen Silurgeschieben gefundenen Ostracoden.

In Jahrb. K preuss. geol. Landesanstalt 1889, p. 80, Berlin, 2 plates.

Leperditia phaseolus His. *L. phaseolus* His. var. *subpentagona* n. var. *L.*

Koch (C.) Ueber das Vorkommen von *Homalonotus* Arten in den rheinischen Unterdevon.

In Verhandl. Naturhist. Vereins d. Preuss. Rheinlande und Westfalens. Vierte Folge, 7 Jahrgang, Bonn 1880, p. 132.

Homalonotus armata Burm. *H. rhenanus* Kock. *H. crassicauda* Sandb. *H. scabrosus* Kock. *H. obtusus* Sandb. *H. subarmatus* n. sp. *H. aculeatus* n. sp. *H. ornatus* n. sp. *H. multicostatus* n. sp. *H. mutabilis* n. sp. *H. römeri* DeKon. *H. planus* Sandb.

Kratow (P.) Geologische Forschungen am Westlichen Ural-Abhange in den Gebieten von Tscherdyn und Ssolikamsk.

In Mém. du Comité Géol. St. Petersburgh, vol. 6, part 2, 1888.

In addition to those mentioned on p. 129 Bibliography Palæozoic Crustacea the author describes *Estheria subconcentrica, Estheriella trapezoidalis, E. oblonge, Estheria* sp.?

Küntgen (Carl). Die Trilobiten des K. G. H. naturhistorischen Museums.

In Publications de l'Institut Royal Grand-Ducal de Luxembourg, Tome xvi, 1877, p. 127.

Proetus cuvieri Steininger. *Phacops latifrons* Bronn. *P. brevicauda* Sandb. *Dalmania caudata* Brünn. *Homalonotus platynotus* Dalm. *H. delphinocephalus* Murch. *H. laticauda. H. knightii* Kœnig. *H. obtusus* Sandb. *H. crassicauda* Sandb. *Homalonotus* sp.? *Calymene blumenbachii* Brong.

Laurie (M.) Some Eurypterid Remains from the Upper Silurian Rocks of the Pentland Hills.

In Trans. Royal Soc. Edinburgh, vol. 37, pt. 1, No. 10, pp. 151-161, plates i-iii.

Stylonurus ornatus n. sp. *S. macrophthalmus* n. sp. *Eurypterus scorpioides* H. W. *E. conicus* n. sp. *E. cyclophthalmus* n. sp. *Drepanopterus* n. g. *D. pentlandicus* n. sp.

——— The Anatomy and Relations of the Eurypteridæ.

In Trans. Royal Soc. Edinburgh, vol. 37, pt. 2, No. 24, 1893, pp. 509-528, plates i-ii.

——— Recent Additions to our Knowledge of the Eurypteridæ.

In Natural Science, vol. 3, No. 18, 1893, pp. 124-127.

Lima (W. De). Note sur un nouveau Eurypterus du Rothliegendes de Bussaco (Portugal).

In Comm. da Commissao dos Trabalhos Geol., vol. 2, fasc. 2, 1892, pp. 153–157, plate.

Eurypterus douvillei n. sp.

This Permian species is a small one, characterized by its broad cephalon and thorax and slender abdomen.

Lindström (G.) List of the Fossil Faunas of Sweden. II, Upper Silurian. Stockholm, 1888, 29 pp.

Locke (John). On the fossil *Cryptolithus tesselatus.*

In Proc. Phila. Acad., vol. 1, 1842, pp. 196–197.

Further observations on the same, with woodcut, in the Proceedings, 1843, p. 236.

Matthew (G. F.) Illustrations of the Fauna of the St. John Group, No. 7.

In Trans. Royal Soc. Canada, section 4, 1892, pp. 95–109, plate vii.

Parabolinella posthuma n. sp. *Parabolinella* ?sp. *Cyclognathus rotundifrons* Matt. *Euloma* sp.?

Matthew (W. D.) On Antennæ and other Appendages of *Triarthrus beckii* Green.

In Trans. N. Y. Acad. Sci., vol. 12, 1893, p. 137, plate; also Am. Jour. Sci., 3d series, vol. 46, 1893, p. 121, plate.

——— Sur le développement des premiers Trilobites.

Maurer (F.) Mittheilungen über Fauna and Gliederung des rechtsrheinischen Unterdevon.

In N. Jahr. Min. Geol., Jahrgang 1890, ii Band.

Proetus orbitatus Barr. *P. strengi* Maurer. *P. koeneni* Maurer. *Proetus* conf. *P. myops* Barr. *P. glaber* Maurer. *Proetus* conf. *P. neglectus* Barr. *P. crassirhachis*, A. Römer, *A. catillus* Maurer. *Homalonotus armatus* Burm. *H. ornatus* Kock. *Phacops fecundus* conf. var. *major* Barr. *P. latifrons* Bronn.

McCoy (F.) Ueber die Naturgeschichte von Victoria in alter und neuer Zeit.

In Die Colonie Victoria in Australien; ihr Fortschritt, ihre Hilfsquellen und ihr physikalischer Charakter. Melbourne, 1861, p. 165.

Hymenocaris salteri n. sp.

This species has remained for over thirty years without a description. The name has appeared in print at intervals, first in McCoy's Ancient and Recent Nat. Hist. Victoria (Victoria Intercol. Exhib. Essays, 1861, p. 162), and also in Ann. Mag. Nat. Hist., 1867, vol. 20, p. 201, and in Smyth's Ann. Rep. 2d Geol. Sur., Vict., 1874, p. 33. Salter, in the Quart. Jour. Geol. Soc., 1863, vol. 19, p. 139, in a note refers the species to *Caryocaris salteri*. The species is now referred by Etheridge, Records Geol. Sur. N. S. Wales, vol. 3, 1892, pt. 1, p. 5, to *Lingulocaris McCoyi* sp. nov.

Miller (S. A.) Palæontology.

In 18th Annual Report Department of Geology and Natural Resources of Indiana. Indianapolis, 1894, pp. 257-356, 12 plates.

Mesothyra gurleyi n. sp. *Macrocaris* n. gen. *M. gorbyi* n. sp.

Miller (S. A.) and **Gurley** (Wm. F. E.) Bulletin No. 3 of the Illinois State Museum of Natural History. Description of some new species of Invertebrates from the Palæozoic rocks of Illinois and adjacent states. Springfield, 1894. 81 pp., 8 plates.

Illænus danielsi n. sp. *Lichas hanoverensis* n. sp. *L. byrnesanus* n. sp. *Ceraurus milleranus* n. sp.

Moriere (J.) Note sur un Homalonotus du grès de May.

In Bull. Soc. Linn., 3d series, vol. 8, 1884, p. 383, 2 plates.

Homalonotus deslongchampsi Trom.

——— Note sur quelques Trilobites de l'étage du grès de May.

In Bull. Soc. Linn. Normandie, vol. 9, 1884–85, 3d series, pp. 74–85, plates i–ii.

Homalonotus bonissenti n. sp. *H. serratus* Trom. *H. brongniarti* Deslong. *H. fugitivus* Trom. *Asaphus carabeufi.*

Novák (O.) On the occurrence of a new form of *Discinocaris* in the Graptolitic beds of the Colonie Haidinger in Bohemia.

In Geol. Magazine, Decade 3, vol. 9, 1892, p. 148.

Discinocaris dustiana n. sp.

D'Orbigny (A.)

In Bull. Soc. Géol. France, vol. 14, 1842–1843, p. 563.

This paper contains a discussion by D'Orbigny, Michelin and Huot regarding the habits of Trilobites in general. No genera are mentioned.

Peach (B. N.) On a new Eurypterid from the Upper Coal Measures of Radstock, Somersetshire.

In Proc. Royal Phy. Soc. Edinburgh, vol. 9, 1885–88, p. 438, plate xx.

Glyptoscorpius Kidstoni n. sp. *Eurypterus remipes* Dekay, ornamentation of *Illænus*, after Salter.

——— Additions to the fauna of the Olenellus zone of the Northwest Highlands.

In Quart. Jour. Geol. Soc. London, vol. 50, 1894, pp. 661–676, plates xxix–xxxii.

Olenellus lapworthi, also var. *elongatus*, *O. reticulatus*, *Olenelloides* n.

Remelé (A.) and **Dames** (W.) Rechtigstellung einer auf die Phacopiden species *Homalops altumii* Remelé, bezüglichen Augabe.

In Zeitschrift Deutsch. Geol. Gesellsch., vol. 40, 1888, p. 586.

Reuss (A. E.) Ueber Entomostraceen und Foraminiferen im Zechstein der Wetterau.

In Jahres. Ber. d. Wetterauer Gesellsch. für 1851-53, p. 59, plate i.

1, *Bairdia gracilis* McCoy. 2, *B. geinitziana* Jones. 3, *B. Kingi* n. sp. 4, *B. plebeia* n. sp. 5, *B. mucronata* n. sp. 6, *B. ampla* n. sp. 7, *B. frumentum* n. sp. 8? *Cytherella nuciformis* Jones. 9, *Cythere bituberculata* n. sp. 10, *C. rœssleri* n. sp.

Richter (R.) Beiträge zur Palæontologie Thüringens Waldes. Dresden und Leipzig.

The author describes from the Devonian of Saalfeld a badly preserved crustacean under the name of *Gitocranyon granulatus* in addition to those mentioned of p. 184 of the Bibliography Palæozoic Crustacea.

Roemer (Ferd.) Geologie von Oberschlesien. Breslau, 1870. Atlas of 50 plates, maps and sections.

The author illustrates the following species: *Homalonotus crassicauda* Sandb. *Cyphaspis* sp. *Phacops latifrons* Bronn. *Phillipsia latispinosa* Sandb. *P. margintifera* F. Roemer. *P. mucronata* n. sp.

Sandberger (F. v.) Ueber die Entwickelung der unteren Abtheilung des devonischen Systems in Nassau, verglichen mit jener in anderen Ländern. Nebst einem paläontologischen Anhang.

In Jahrb. Nassauischen Vereins für Naturkunde Jahrg. xlii, 1889, pp. 1-108, plates i-v.

Phacops Ferdinandi Kayser, pl. iii, fig. 4.

The author also enumerates the fossil crustacea of the Devonian System in Nassau.

Schauroth (Baron von) Ein Beitrag zur Paläontologie des deutschen Zechsteingebirges.

In Zeitsch. deutschen Geol. Gesellschaft, vol. 6, 1854, pp. 539-577.

Palæocrangon n. g. *Hemitrochiscus paradoxus*.

Schenk (A.) Die geolische Entwickelung Sudafrikas.

In Petermann's Mitth., 34 Bd., 1888, p. 224.

Proetus ricardi. *Encrinurus cristagalli*. *Homalonotus herschelii*. *Phacops Africanus*. *P. kafir*.

Not descriptive.

Schmidt (Friedrich) Ueber eine neuentdeckte untercambrische Fauna.

In Mém. Acad. Imp. Sci. St. Petersburgh, vol. 36, No. 2, 1888, p. 27, plates i-ii.

Olenellus Mickwitzi n. sp.

——— Revision der ostbaltischen silurischen Trilobiten. Abtheilung iv. Calymeniden, Proetiden, Bronteiden, Harpediden, Trinucleiden, Remopleuriden und Agnostiden.

In Mém. Acad. Imp. des Sci., St. Petersb., 7th series, vol. 42, No. 5, pp. 1-93, plates i-vi, 1894.

Calymene tuberculata Brünn. *C. intermedia* Lindstr. *C. frontosa* Lindstr. *C. conspicua* n. sp. *C. ohhesaarensis* n. sp. *C. senaria* Conr. var. *Stacyi*. Subgen. *Pharostoma* Conr. *P. pediloba* F. Röm. *P. Nieszkowskii* n. sp. *P. denticulata* Eichw. Subgen. *Ptychometopus* Schm. *P. Solborthi* n. sp. *Bronteus laticauda* Wahlb. *B. estonicus* n. sp. *B. Marklini* Ang.? *Proetus concinnus* Dalm. var. *osiliensis*. *P. verrucosus* Lindstr. aff. *S. conspersus* Ang. *P. planedorsatus* n. sp. *P.* cf. *distans* Lindstr. *P. ramisulcatus* Nieszk. *P. Kertelensis* n. sp. *P. Wesenbergensis* n. sp. *Cyphaspis elegantula* Lov. *C. planifrons* Eichw. *Menocephalus minutus* Nieszk. *Harpides Plautini* n. sp. *Harpes Spasskii* Eichw. *H. Wegelini* Ang. *Trinucleus seticornis* His. *Ampyx nasutus* Dalm. *A. Volborthi* n. sp. *A. Linnarssoni* n. sp. *A. costatus* S. et B. *A. rostratus* Sars. *Remopleurides nanus* Leuchtb. *R.* var. *elongata* Schm. *R. emarginatus* Törnq. *Agnostus glaber* Ang. var. *ingrica*.

Toll (Edward von). Die paläozoischen Versteinerungen der Neusibirischen Insel Kotelny.

In Mém. Acad. Imp. Sci. St. Petersburgh, vol. 37, No. 3, 1889.

Phacops quadrilineata Ang. *Monorakos Schmidti*, n. sp. *Proetus* sp.? *Bronteus Andersoni* Eth. jr. et Nich. *Leperditia Kotelnyensis* n. sp. *L. arctica* Jones. *L. Czesskii* n. sp. *L. Sannikowi* n. sp. *L. Keyserlingi* Schm. *Leperditia* sp.?

Toula (F.) Eine Kohlenkalk-Fauna von der Barents-Inseln.

In Sitzungsberichte der Akad. der Wissenschaften, Wien, vol. 71, 1875, Abth. 1, p. 527, 6 plates.

Phillipsia Grünewaldti Möller.

Tromelin (G.) Étude de la faune du grès Silurien dans le Calvados.

In Bull. Soc. Linn. Normandie, 3d series, vol. 1, 1876–77.

Homalonotus deslongchampsi n. sp. *H. brongniarti* Delong. *H. serratus* n. sp. *H. vicaryi* Salt. *Plæsiacomia (Homalonotus) brevicaudata* Delong. *Illænus docens* Trom. *I. viducassianus* Trom. *Dalmanites incerta* Delong.

——— Under the heading of Phyllopodes belonging to the Grès des May (Calvados) the author cites two species of *Ribeiria.*

In Bull. Soc. Linn. Normandie, series 3, vol. 1, 1887, pp. 35, 74.

The author states that Mr. Salter has named but not described two species of *Ribeiria* from Mr. Vicary's collection, *R. conformis* Salt and *R. magnifica* Salt.

Tromelin (G. De) et **Lebesconte** (P.) Essai d'un catalogue raisonné des fossiles Siluriens des départments de Maine-et-Loire, de la Loire Inférieure et du Morbihan, (Anjou et Bretagne méridionale), avec des observations sur les terrains paléozoiques de l'ouest de la France.

(Extrait du compte-rendu de la 4th Session Nantes, 1875) de l'Assoc. française l'adv. Sc., pp. 601-661.

——— Présentation de fossiles paléoiques du départment d'Ille-et-Vilaine et Note additionelle sur la Fauna Silurien de l'ouest de la France.

In Assoc. franc. l'adv. Sc., 1875, pp. 683–687.

——— Observations sur les terrains primaires du Nord du Department d'Ille-et-Vilaine et de quelques autres parties du massif breton.

In Bull. Géol. Soc. France, 3d series, vol. 4, 1875-76, pp. 583-623.

Dalmanitis rouaulti n. sp. *D. incertus*. *D. minus* Salt. *D. phillipsi* Barr. *Calymene bayani* T. & L. *Homalonotus brongniarti* Desl. *H. vicaryi* Salt. *Trinucleus goldfussi*. *Homalonotus gahardensis* n. sp.

There is a note to this article on p. 612, in which *Bronteus thysanopeltis* Caill. (non Barr.) is mentioned.

Tromelin (Gaston Le Goarant de). Letter sur le terrain Silurien de la Sarthe.

In Bull. Agriculture Sci. at Arts de la Sarthe, vol. 22, 1874, pp. 582-590.

Cerateocaris Cenomanesis n. sp. *C. Bohemica* Barr. *C. inæqualis* Barr.

Ulrich (Arnold). Beiträge zur Geologie und Paläontologie von Südamerica unter Mitwirkung von Fachgenossen, herausgegeben von Dr. Gustav Steinmann. I Palæozoische Versteinerungen aus Bolivien von A. Ulrich.

In Neues Jahrb. für Min. viii. Beilage Bd., 1892, Hefte 1-2; also published separately. Stuttgart, 1892, vol. 1, p. 116, 5 plates.

Acaste devonica n. sp. *Cryphæus convexus* n. sp. *C. giganteus* n. sp. *Cryphæus* sp. *Cyphaspis* sp. *Dalmanites Clarkei* n. sp. *Phacops Dagincourti* n. sp. *Phacops* sp.

Ulrich (E. O.) The Lower Silurian Ostracoda of var. *incurva* n. var. *E. subradiata* Ul. *E. ventrosa* n. sp. *E.? subæquata* n. sp. *E.? symmetrica* n. sp. *Dicranella* n. gen. *D. bicornis* n. sp. *D. spinosa* n. sp. *D. marginata* n. sp. *D.? simplex* n. sp. *Jonesella* Ulrich. *J. obscura* n. sp. *Bollia* Jones & Holl. *B. subæquata* n. sp. *B. Unguloidea* n. sp. *Drepanella* Ulrich. *D. bilateralis* n. sp. *D. bigeneris* n. sp. *Dilobella* n. gen. *D. typa* n. sp. *Ctenobolbina* Ulrich. *C. fulcrata* n. sp. *C. crassa* Ul. *Ceratopsis* n. gen. *C. chambersi* Miller; also var. *robusta* n. var. *Tetradella* Ulrich. *T. quadrilirata* H. & W., and varieties. *T. lunatifera* Ul. *Moorea* Jones & Kirkby. *M. angularis* n. sp. *M. punctata* n. sp. *M.? perplexa* n. sp. *Macronotella* n. gen. *M. scofieldi* n. sp. *Cytherella* Jones & Bosquet. *C.? subrotunda* n. sp. *C.? rugosa* Jones and var. *arcta* n. var. *Bythocypris* Brady. *B. cylindrica* Hall. *B.? curta* n. sp. *B. granti* n. sp. *B.? robusta* n. sp. *Krausella* n. gen. *K. inæqualis* n. sp. *K. arcuata* n. sp.

——— Two new Lower Silurian species of *Lichas* (subgenus) *Hoplolichas*.

In the Am. Geologist, vol. 10, 1892, p. 270.

Lichas (Hoplolichas) robbinsi n. sp. *L. (Hoplolichas) bicornis* n. sp.

——— New Lower Silurian ostracoda. No. 1.

In the Am. Geologist, vol. 10, 1892, p. 263, plate ix.

Leperditia tumida n. sp. *L. mundula* n. sp. *L. æquilatera* n. sp. *L. inflata* n. sp. *L. germana* n. sp. *L. sulcata* n. sp. and *ventricornis* n. var. *L. (?Primitia) dorsicornis* n. sp. *L. granilabiata* n. sp. *L. millepunctata* n. sp. *L. fimbriata* n. sp. *Schmidtella* n. g. *S. crassimarginata* n. sp.

Vogdes (A. W.) Notes on Palæozoic Crustacea, No. 4. On a new Trilobite from Arkansas Lower Coal Measures.

In Proc. Cal. Acad. Sci., 2d series, vol. 4, 1895, pp. 589–591.

Griffithides ornata n. sp.

Waagen (W.) Salt Range Fossils.

In Mem. Geol. Sur. India, series 13, vol. 4, part 2. Calcutta, 1891.

Olenus indicus n. sp. *Conocephalites Warthi* n. sp.

Walcott (Chas. D.) Note on some appendages of the Trilobites.

In Proc. Biological Soc. Washington, vol. 9, 1894, pp. 89–97, plate.

Triarthrus becki Green. *Calymene senaria* Conrad.

Weitenweber (W. R.) Systemisch Verzeichniss der Böhmen Trilobiten.

In Lotos, vol. 7, 1857.

——— Einige historische Bemerkungen über die Silurische Fauna Böhmens, insbesondere über die Trilobiten.

In Sitzungsberichte der K. böhm. Ges. Wissenschaften, Prag 1861, pp. 13-14.

The author enumerates some new species and specimens of the collection of the Prälat Zeidler at Strabow. He gives only the names without descriptions or figures, as follows:

Paradoxides Sacheri, Proetus myops, P. eremita, P. astyanax, P. frontalis, P. Lyelli, Dalmanites McCoyi, D. Fletcheri, Cyphaspis Halli, Lichas simplex, Trinucleus ultimus, Asaphus alienus, Illænus transfuga, Acidaspis Laportei, Amphion senilis, Cromus transiens, Bronteus infaustus, B. furcifer.

Whidborne (G. F.) On some Devonian Crustaceans.

In Report Brit. Assoc., 1888, p. 681.

Entomis peregrina n. sp. *Acidaspis robertsii* n. sp. *A. hughesii* n. sp. *Proetus batillus* n. sp. *P. subfrontalis* n. sp. *P. audax*. *Cyphaspis ocellatus* n. sp. *Lichas devonianus* n. sp. *Bactropus decoratus* n. sp. *Cheirurus pengellii* n. sp. *Bronteus granulatus* Goldf.

——— On some Devonian Crustacea.

In Geol. Magazine, Decade 3, vol. 6, 1889, p. 28. Abstract of a paper read at the British Association. The author gives a brief description of the following new species from Wolborough and Lummaton:

Phacops batracheus, Proetus batillus, P. subfrontalis, P. audax, Cyphaspis ocellata, Lichas devonianus, Acidaspis robertsii, A. hughesii, Bronteus sp. *Polycope simplex* J. & K. *P. devonica* Jones, also var. *major*, *obliqua* and *concinna*. *P. hughesiæ* n. sp. *Entomis peregrina* Whid. *Cyprosina whidbornei* Jones.

Whiteaves (J. F.) Description of Four New Species of Fossils from the Silurian Rocks of the Southeastern Portion of the District of Saskatchewa.

In Canadian Record Sci., April, 1891.

Acidaspis perarmata n. sp.

Wood (Henry). Catalogue of the Fossils in the Students' Stratigraphical Series. Cambridge, 1893, 23 pp.

——— Additions to the Type Fossils in the Woodwardian Museum.

In Geol. Magazine, Decade 3, vol. 10, 1893, p. 111.

Woods (H.) and **Hughes** (T. McKenny). Catalogue of the Type Fossils in the Woodwardian Museum. Cambridge, 1891, 180 pp.

Woodward (H.) Note on a new British Species of *Cyclus* from the Coal Measures of Racup, Lancashire.

In Geol. Magazine, Decade 3, vol. 10, 1893, p. 28.

Cyclus Scotti n. sp.

——— Some points in the Life History of the Crustacea in early Palæozoic times.

In address delivered at meeting Geol. Soc. London, Feb. 15, 1895. Proceeding Geol. Soc., May, 1895, pp. lxx-lxxxviii.

Young (J.) Note on a Series of Trilobites of Caradoc age from the Silurian Strata of the Girvan Valley.

In Proc. Nat. Hist. Soc. Glasgow, vol. 2, 1876, pt. 2, p. 179.

Illænus bowmanni Salt. *I. thomsoni* Salt. *I. barriensis* Murch. *Cybele verrucosa* Dalm. *Proetus latifrons* McCoy. *Zethus rugosus* Portl. *Cheirurus clavifrons* Dalm. *Odontopleura ovata?* *Staurocephalus unicus* Wyv. Thomson.

The author notes the identification of the above species in the Gray collection.

——— On new forms of Crustacea from the Silurian rocks at Girvan.

In Proc. Nat. Hist. Soc. Glasgow, vol. 1, 1868, p. 169.

Cheirurus trispinosus n. sp. *Solenocaris* n. g. *S. solenoides* n. sp.

——— Note on a new species of Crustacean belonging to the genus *Solenocaris* from the Silurian Strata near Girvan, and on fragments probably the appendages of a Trilobite or Limulid Crustacean.

In Proc. Nat. Hist. Soc. Glasgow, vol. 2, 1875, p. 66.

——— Notes on the group of Carboniferous Ostracoda found in the Strata of Western Scotland.

In Trans. Glasgow Geol. Soc., vol. 9, pt. 2, 1890-91, 1891-93, p. 301.

A REVIEW OF THE HERPETOLOGY OF LOWER CALIFORNIA. PART I—REPTILES.

BY JOHN VAN DENBURGH,
Curator of the Department of Herpetology.

[With Plates iv-xiv.]

The peninsula of Lower California lies so far from the usual routes of travel that few collections of its animals have found their way into museums. Its reptiles have been known chiefly from the specimens secured by Botta, Xantus, and Belding. Within the past few years the California Academy of Sciences has sent several collectors to the peninsula, and among the specimens brought back each time have been a few reptiles. In this way the collection has been formed upon which this paper is primarily based.

A few remarks on the zoögeographical position of Lower California may not be out of place.

The Sonoran Subprovince, as defined by Dr. Allen, but excluding Lower California, is inhabited by the following forty genera of reptiles:*

Phyllodactylus,
Dipsosaurus,
Crotaphytus,
Callisaurus,
Holbrookia,
Uma,
Sauromalus,
Uta,
Sceloporus,
Phrynosoma,
Heloderma,
Gerrhonotus,
Anniella,
Xantusia,
Cnemidophorus,
Verticaria,
Eumeces,
Rena,
Leptotyphlops,
Lichanura,
Charina,
Chilomeniscus,
Tantilla,
Chionactis,
Rhinochilus,
Lampropeltis,
Diadophis,
Contia,
Gyalopum,
Hypsiglena,
Phyllorhynchus,
Salvadora,
Bascanion,
Pituophis,
Arizona,
Thamnophis,
Natrix,
Trimorphodon,
Elaps,
Crotalus.

Twenty-nine of these range over a greater or less part of the Campestrian Subprovince on the north, or of the tropical Central American Region on the south. They need not, therefore, be considered in the present connection. Eleven genera remain which are confined to the Sonoran Subprovince, and may be considered characteristic of that area. These genera are:

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* The turtles are not considered in this discussion.

Dipsosaurus,
Callisaurus,
Holbrookia,
Uma,
Sauromalus,
Heloderma,
Xantusia,
Verticaria,
Rena,
Lichanura,
Phyllorhynchus.

In the so-called Cape Region of Lower California, twenty-eight genera of reptiles occur, namely:

Phyllodactylus,
Ctenosaura,
Dipsosaurus,
Crotaphytus,
Callisaurus,
Uta,
Sceloporus,
Phrynosoma,
Gerrhonotus,
Xantusia,
Cnemidophorus,
Verticaria,
Eumeces,
Euchirotes,
Rena,
Lichanura,
Chilomeniscus,
Tantilla,
Lampropeltis,
Hypsiglena,
Phyllorhynchus,
Salvadora,
Bascanion,
Pituophis,
Thamnophis,
Natrix,
Trimorphodon,
Crotalus.

Only two of these have not been obtained elsewhere in the Sonoran Subprovince, while, with the exception of chiefly Campestrian or tropical distribution, leaving fifty-seven species which may be considered distinctively Sonoran.

Thirty-eight species have thus far been found in the southern part of Lower California,[*] as follows:

Phyllodactylus tuberculosus,
Phyllodactylus unctus,
Ctenosaura hemilopha,
Dipsosaurus dorsalis,
Crotaphytus copeii,
Callisaurus draconoides,
Uta thalassina,
Uta stansburiana,
Uta nigricauda,
Sceloporus zosteromus,
Sceloporus licki,
Phrynosoma coronatum,
Gerrhonotus multicarinatus,
Xantusia gilberti,
Cnemidophorus maximus,
Verticaria hyperythra,
Eumeces lagunensis,
Euchirotes biporus,
Rena humilis,
Lichanura trivirgata,
Chilomeniscus stramineus,
Chilomeniscus fasciatus,
Tantilla planiceps,
Lampropeltis conjuncta,
Lampropeltis nitida,
Hypsiglena ochrorhyncha,
Phyllorhynchus decurtatus,
Salvadora grahamiæ,
Bascanion flagellum frenatum,
Bascanion aurigulum,
Pituophis vertebralis,
Thamnophis cyrtopsis collaris,
Natrix valida,
Natrix celæno,
Trimorphodon lyrophanes,
Crotalus atrox,
Crotalus enyo,
Crotalus mitchellii.

None of these have been found upon the tropical Mexican mainland. *Uta nigricauda*, *Sceloporus zosteromus*, *Phrynosoma coronatum*, and *Phyllorhynchus decurtatus*, range considerably north of the confines of the "Cape Region." Twenty-two of the thirty-eight species are of very limited distribution, having been found only in the extreme southern part of the peninsula. The remaining twelve forms, mentioned below, extend their range over a greater or less part of the Sonoran Subprovince, and are among those characteristic of that area.[†]

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[*] Several species, as *Xantusia vigilis*, *Charina bottæ*, and *Lampropeltis californiæ*, have often been credited to Lower California without evidence of their occurring there.

[†] Except *Uta stansburiana*, which is also Campestrian.

Phyllodactylus tuberculosus,
Dipsosaurus dorsalis,
Uta stansburiana,
Rena humilis,
Hypsiglena ochrorhyncha,
Salvadora grahamiæ,
Bascanion flagellum frenatum,
Thamnophis cyrtopsis collaris,
Natrix valida,
Trimorphodon lyrophanes,
Crotalus atrox,
Crotalus mitchellii.

Formulating these data we have the following tables:

GENERA.

Total number in the Sonoran Subprovince	40
Confined to the Sonoran Subprovince	11
Total number in the "Cape Region"	29
Restricted to the "Cape Region"	1
Common to the "Cape Region" and Tropical America	1
Common to the "Cape Region" and the Sonoran Subprovince	26

SPECIES.

Total number in the Sonoran Subprovince	78
Confined to the Sonoran Subprovince	57
Total number in the "Cape Region"	38
Restricted to the "Cape Region"	22
Common to the "Cape Region" and Tropical America	0
Common to the "Cape Region" and the Sonoran Subprovince	12

From these it appears that the affinities of the reptiles which inhabit southern Lower California are almost entirely with those of the Sonoran Subprovince, of which the "Cape Region," therefore, forms a part. It is also

There is in this area, as has already been shown, a slight infusion of tropical forms, represented among reptiles by the genera Ctenosaura and Euchirotes, but probably best illustrated by the plants growing near the coast lagoons. These forms, however, are doubtless no more numerous or characteristic than those forms, of tropical origin, which will be found to intrude upon the entire southern border of the Sonoran Subprovince.

The northern part of Lower California is much more closely related to the rest of the Sonoran Subprovince than to the San Lucas Fauna. This is well shown by the presence of such forms as *Callisaurus ventralis*, *Crotaphytus wislizenii*, *Phrynosoma solare*, *Rhinochilus lecontei*, and *Cnemidophori* of the *tessellatus* group. While the known ranges of several species may be considerably enlarged in the future, the northwestern part of Lower California and the coastal slopes of San Diego (and Los Angeles?) County, California, seem to be so well characterized as to merit recognition as a distinct faunal area of the lowest rank. Its distinctive features are the presence of certain peculiar species, the absence of others occurring near by, and its forming the limit of distribution of species whose chief habitat is either north or south.*

Pending further evidence, this area may be known as the San Diegan Fauna.† Among the reptiles peculiar to it may be mentioned the following:‡

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*In this connection I have had the use of a large collection of the reptiles of San Diego County, made by Messrs. Hyatt and Stoddard for the Leland Stanford Junior University, as well as the specimens belonging to the Academy.

†When this was written the author was not aware that this area had been previously recognized and mapped from study of other branches of animal life.

‡Birds apparently belonging to the same list are *Pipilo fuscus senicula*, *Harporhynchus cinereus mearnsi*, and *Heleodytes brunneicapillus bryanti*.

Uta mearnsi (?),
Sceloporus orcutti,
Phrynosoma blainvillii,
Xantusia henshawi,
Cnemidophorus stejnegeri,
Verticaria hyperythra beldingi (?),
Lichanura roseofusca,
Lichanura orcutti.

Several forms of the neighboring areas have not been taken here, namely:

Uta repens,
Uta microscutata (?),
Cnemidophorus rubidus,
Cnemidophorus tigris,
Xantusia vigilis,
Sauromalus ater,
Sceloporus magister,
Sceloporus occidentalis,
Phrynosoma frontale,
Crotalus cerastes.

Northern species which have not been collected south of this area are:

Sceloporus biseriatus,
Sceloporus graciosus,
Gerrhonotus scincicauda,
Anniella pulchra,
Eumeces skiltonianus (?),
Lampropeltis boylii,
Bascanion laterale,
Crotalus lucifer.

A few southern forms are also limited by it, as:

Sceloporus zosteromus,
Crotalus atrox.

The reptiles of the islands which naturally belong to Lower California may be divided into two groups, as follows:

(a) Species which are purely insular; as, *Sauroma-*

tions are all based upon alcoholic specimens. The colors have been determined by reference to Ridgway's "Nomenclature of Colors." Measurements are given in millimeters, unless otherwise stated. Only references to a species as it occurs in Lower California are included in the synonymies, except that the original description is cited in all cases. Whenever a citation has not been verified by actual reference to the original article, it has been given in quotation marks. When the article contains no original information about the species as it occurs in Lower California, the citation has been put in parenthesis. Most of the localities mentioned may be found on the map of Lower California, published in the second volume of the second series of these Proceedings.

I am indebted to Dr. Leonhard Stejneger for the re-identification of many of the specimens listed by Dr. Yarrow, and for the loan of specimens of *Sceloporus consobrinus*.

CARETTA IMBRICATA (L.)

Testudo imbricata.
(1766, Linn., Syst. Nat., 1, p. 350.)
Chelonia imbricata.
1887, Cope, Bull. U. S. Nat. Mus., No. 32, p. 24.

The Academy's collection contains a single carapace (No. 2249) of this turtle. It was obtained at San José del Cabo, by the Expedition of 1893. Mr. Bryant tells me that he has often seen them in the waters near the shore.

CHELONIA AGASSIZII Dum. & Boc.

Chelonia agassizii.
(1870, Duméril et Bocourt, Miss. Sci. au Mex., Reptiles, 1e livr., p. 26, pl. vi.)
1887, Cope, Bull. U. S. Nat. Mus., No. 32, p. 24.
Chelonia virgata.
1883, True, Bull. U. S. Nat. Mus., No. 24, p. 28.

The green turtle has been taken at Cape San Lucas. It doubtless occurs in many places along the coast of the peninsula.

CHRYSEMYS NEBULOSA, new species. Plates iv, v and vi.

Pseudemys ornata.
1883, True, Bull. U. S. Nat. Mus., No. 24, p. 33.

Diagnosis.—Allied to *C. ornata* (Gray), but without black centers in the costal ocelli, which are much more irregular and indistinct than in that form. The markings on the head, neck, and limbs, are much coarser, and the longitudinal lines less numerous. There are four yellow rays on the upper surface of the arm, instead of eleven.

Type.—Cal. Acad. Sci. No. 2244, "Mainland abreast of San José Island," Lower California,* W. E. Bryant.

Description of the Type.—The neck is clove brown with several pale longitudinal lines on each side. The highest one of these ends on the temple in a large oval spot of the same color. The lowest and largest is continued forward across the middle of the lower eyelid, giving off, at the lower edge of the inferior maxillary bone, a branch which, continuing forward, crosses to the seal brown blotches, not at all like the double lines on this region in *C. ornata*.

Length of carapace 80 mm. Its greatest width 63 mm.

A carapace (No. 2246) 283 mm. in length is much less distinctly marked than the type, but has a rather indistinct black-centered ocellus on each of the last pair of costal scutes. Another (No. 2247) 273 mm. long shows no trace of these ocelli, nor are they visible in the other alcoholic specimen (No. 2245), the carapace of which measures 194 mm.

List of Specimens of Chrysemys nebulosa.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
2244	Lower California,* abreast of San José Island.		W. E. Bryant.
2245	No data.*		
2246	" †		
2247	San José del Cabo, L. C.		Gustav Eisen.

PHYLLODACTYLUS TUBERCULOSUS Wieg.

Phyllodactylus tuberculosus.

"(1835, Wiegmann, Acta. Acad. Cæs. Leop. Carol., xvii, 1, p. 241, pl. xviii, fig. 2.)"

(1887, Cope, Bull. U. S. Nat. Mus., No, 32, p. 28.)

Phyllodactylus xanti.

1863, Cope, Proc. Ac. Nat. Sci. Phila., p. 102.

(1866, Cope, Proc. Ac. Nat. Sci. Phila., p. 312.)

(1875, Cope, Bull. U. S. Nat. Mus., No. 1, pp. 50, 93.)

1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 73.

(1884, S. Garman, Bull. Essex Inst., xvi, 1, p. 12.)

(1887, Belding, West Am. Scientist, iii, 24, p. 98.)

The writer has not seen this species, which has been recorded from Cape San Lucas and La Paz.

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* From Los Dolores, by W. E. Bryant, fide Bryant, from memory.

† From Agua Caliente, by W. E. Bryant, fide Bryant, from memory.

PHYLLODACTYLUS UNCTUS (Cope).

Diplodactylus unctus.
1863, Cope, Proc. Ac. Nat. Sci. Phila., p. 102.
(1866, Cope, Proc. Ac. Nat. Sci. Phila., p. 312.)
(1875, Cope, Bull. U. S. Nat. Mus., No. 1, pp. 50, 93.)
1877, Streets, Bull. U. S. Nat. Mus., No. 7, p. 35.
1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 73.
(1884, S. Garman, Bull. Essex Inst., xvi, 1, p. 12.)
(1887, Belding, West Am. Scientist, iii, 24, p. 98.)
Phyllodactylus unctus.
(1873, Bocourt, Miss. Sci. au Mex., Reptiles, 2e livr., p. 43.)
(1885, Boulenger, Cat. Lizards Brit. Mus., I, p. 94.)
(1887, Cope, Bull. U. S. Nat. Mus., No. 32, p. 28.)
(1890, Townsend, Proc. U. S. Nat. Mus., xiii, p. 144.

Description of No. 886.—The head is much longer than broad. The rounded snout is longer than the distance between the eye and the ear opening. The lips are very prominent. The ear opening is a narrow slit, about the length of the pupil, and has a slight denticulation posteriorly. The scales on the eyelids form a rather conspicuous comb. The slender digits are covered below with a series of transverse lamellæ, terminated by two large plates which are somewhat rounded and wider distally than proximally. The nostril is pierced between has large plates below, and is covered elsewhere with smooth flat scales which are somewhat larger than those on the back.

Variation.—There is great variation in the ground color of the head and back. In some specimens it is pale gray or creamy white, while in others the prevailing tint is a dark seal brown. There are, however, some fairly constant markings, brighter in young than in old individuals, but apparently subject like the ground color, though to a less extent, to modification in accordance with the amount of light, or perhaps in obedience to the will of the animal. These markings are of a deeper seal brown than the ground color of the darkest individuals. A line originates on the second labial plate, and, passing through the eye and the upper end of the ear opening, runs for some distance along the neck. The upper surface of the head is blotched and spotted, as are also the limbs. The tail has about nine cross-bars on its upper surface. All the lower surfaces are creamy white, slightly tinged with brown in the darkest specimens. The scales are everywhere minutely punctulated with dark brown.

	mm.	mm.	mm.	mm.
Length to anus	45	46	35	42
Tail	48*	40*	31*	—
Hind limb	18	18	15	17
Fore limb	15	15	11	14
Head to ear	12	12	10	10½
Snout to orbit	5	5½	4	4½
Diameter of orbit	3½	3	3	3

Phyllodactylus unctus has been previously recorded from Cape San Lucas (the type locality), by Mr. Xantus; from Triunfo, by Dr. Streets; and from La Paz, by Messrs. Belding and Townsend.

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* Reproduced.

List of Specimens of Phyllodactylus unctus.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
857	San José del Cabo, L. C.	Oct., 1893.	Gustav Eisen.
885 to 893	San José del Cabo, L. C.	Jan. 25, 1893	Gustav Eisen.
1182	Miraflores, L. C.	Sept., 1894.	Eisen and Vaslit.
1663 to 1669	San José del Cabo, L. C.	"	"
2204 to 2207	Lower California.		

CTENOSAURA HEMILOPHA Cope.

Iguana acanthura.

"1835, Blainville, Nouv. Ann. Mus., iv, p. 288, pl. xxiv. fig. 1."

Cyclura acanthura.

1837, Duméril et Bibron, Erpétologie Générale, iv, p. 222 (part).

(1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 71.)

(1887, Belding, West Am. Scientist, iii, 24, p. 98.)

Ctenosaura.

1895, Baird, Proc. Ac. Nat. Sci. Phila., p. 300.

Cyclura (Ctenosaura) hemilopha.

compressed. The tail is conical except at its base, where it is almost square in section. The limbs and head are large, the latter sharply triangular and with flattened top and almost vertical sides. The large nostril is in a round plate, whose posterior edge is nearer to the orbit than to the end of the snout. The rostral and symphysial plates are very broad and low. There are ten labials. There is a very large plate below the eye, and a series of large superciliaries. The entire top and sides of the head are covered with small irregularly hexagonal plates, which are convex, except on the snout and lores. The very large ear opening is almost vertical and without denticulation. Several series of large sublabial plates pass gradually into the gulars. The dorsal crest begins some distance behind the shielded part of the head, is composed of high spines on the nape, and gradually diminishes in height posteriorly. It is continued on the middle third of the vertebral line as a series of enlarged flat plates, but is not traceable on the posterior third. The back and sides are covered with small, smooth, subquadrate scales, which pass gradually into the larger ventrals. The gular regions are covered with smooth scales which become gradually larger posteriorly. The smallest gulars are larger than the dorsals, the largest are smaller than the ventrals. The scales on the limbs are all smooth. The tail bears whorls of spinose scales. The first three of these whorls are separated from one another by three series of smaller smooth scales; the fourth, fifth and sixth spiny whorls are each preceded by two series of smooth scales, and the more distal whorls by single series which gradually become spinose.

The top and sides of the head are dull pea green. The back, sides, and hind limbs are pale straw color, heavily washed with pale olive, and spotted and reticulated with seal brown and black. There are five black blotches on the vertebral line, separated by areas paler than the general tint. The first of these black markings is very small; the second is broader than long; the third and fourth are very large and faintly continuous with the blackish brown of the ventral surfaces; the fifth is almost confined to the enlarged medial scales. There are two longitudinal black blotches on the side of the neck, and two corresponding lines on the temple. The chin, gular region, chest, and forelimbs, are blackish brown. The tail has a ground color of straw yellow clouded with olive, but is dull pea green on the spines, and barred with seal brown terminally.

Snout to vent 224 mm. Snout to ear 53 mm. Hind limb 129 mm. Snout to edge of fold 76 mm. Fore limb 84 mm. Highest dorsal spines 9 mm.

Variation.—The youngest individuals (58 to 76 mm. from snout to vent) are bright terre-verte green above, except on the tail which has broad rings of dark olive separated by narrow ones of broccoli brown. There are very faint indications of dark vertebral bars. The lower parts are yellowish white tinged with green. As the

List of Specimens of Ctenosaura hemilopha.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
463 to 466	San José del Cabo, L. C.	Mar., 1892.	Gustav Eisen.
703	Miraflores, L. C.	Oct., 1890.	W. E. Bryant.
704	"	"	"
709	San José del Cabo, L. C.	Oct. 10, 1890	"
718	"	Sept. 17, 1890	"
744	Agua Caliente, L. C.	Oct., 1890.	"
830 to 833	San José del Cabo, L. C.	Sept., 1893.	Gustav Eisen.
850 to 855	"	Oct., 1893.	"
858	"	Nov., 1893.	"
859	"	"	"
871	"	"	"
872	"	"	"
985	Pescadero, L. C.	Sept., 1893.	"
991 to 995	Miraflores, L. C.	"	"
998 to 1095	"	Sept., 1894.	Eisen and Vaslit.
1389	Sierra San Lazaro, L. C.	"	"
1620 to 1628	San José del Cabo, L. C.	"	"
2240	"	Mar., 1892.	W. E. Bryant.

DIPSOSAURUS DORSALIS (B. & G.)

Crotaphytus dorsalis.
(1852, Baird and Girard, Proc. Ac. Nat. Sci. Phila., p. 126.)
Dipsosaurus dorsalis.
1859, Baird, Proc. Ac. Nat. Sci. Phila., p. 299.
(1866, Cope, Proc. Ac. Nat. Sci. Phila., p. 312.)
(1875, Cope, Bull. U. S. Nat. Mus., No. 1, p. 48.)
(1880, Lockington, Am. Nat., xiv, p. 295.)
1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 54.
(1885, Boulenger, Cat. Lizards Brit. Mus., ii, p. 201.)
(1887, Cope, Bull. U. S. Nat. Mus., No. 32, p. 34.)
(1887, Belding, West Am. Scientist, iii, 24, p. 97.)
1890, Townsend, Proc. U. S. Nat. Mus., p. 144.
(1893, Stejneger, N. A. Fauna, No. 7, p. 164.)

Specimens of this lizard from the "Cape Region" show a tendency to have but one row of scales between the rostral and nasal plates, while those from northern Lower California and California more frequently have two rows. The following table, based upon two hundred and thirty-one specimens shows this quite plainly:*

Number of scale rows between rostral and nasal	2-2	2-1	1-1
Northern specimens	19	9	13
Specimens from the "Cape Region".....	14	6	170

List of Specimens of Dipsosaurus dorsalis.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
467	San José del Cabo, L. C.	Mar., 1892.	Gustav Eisen.
468	"	"	"
613	"	Sept. 18, 1890	W. E. Bryant.
640	Magdalena Island, L. C.	Mar., 1889.	"
644	Comondu to San Quintin, L.C.	April, 1889.	"
710 to 713	San José del Cabo, L. C.	Sept. 1, 1890	"
716	"	Sept. 9, 1890	"
717	"	Sept. 1, 1890	"
827 to 829	"	Sept., 1893.	Gustav Eisen.
875	"	Aug., 1893.	"
1180	Miraflores, L. C.	Sept., 1894.	Eisen and Vaslit.
1181	"	"	"
1847 to 2011	San José del Cabo, L. C.	"	"
67	Lower California.	——	W. J. Fisher.

CROTAPHYTUS COPEII Yarrow?

Crotaphytus copeii.
1882, Yarrow, Proc. U. S. Nat. Mus., p. 441.
(1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 53.)
(1890, Stejneger, N. A. Fauna, No. 3, p. 105.)
Crotaphytus copii.
(1884, S. Garman, Bull. Essex Inst., xvi, 1, p. 16.)
Crotaphytus copei.
(1887, Cope, Bull. U. S. Nat. Mus., No. 32, p. 45.)
(1887, Belding, West Am. Scientist, iii, 24, p. 97.)

Description of No. 638.—The head is large and considerably depressed. The large nostril is much nearer to the end of the snout than to the orbit. The ear opening is very large, oblique, and with an anterior denticulation of small scales. The scales on the upper surface of the head are very small; largest on the middle third of its length, smallest on the supraocular region. There are twelve superior and twelve inferior labials to below the middle of the eye. All the labials are rectangular, of about equal width, and longer than wide. There are several series of enlarged sublabials, which pass gradually into the granular gulars. The strong gular fold is covered centrally with larger, pointed, imbricate, scales, but has very small granular ones at its edge. The back is covered with small, smooth, weakly pointed, subgranular scales. There is a strong fold along each side of the body between the limbs, and several irregular folds on the neck. The chest and belly are covered with smooth flat scales. The weakly keeled scales on the tail are smaller than the ventrals. There are twenty femoral pores on each side. Male, with enlarged postanals.

The general ground color is pale hair brown, changing to broccoli brown centrally, finely dotted with white and cream-buff, and with small spots of very dark sepia which increase slightly in size medially and posteriorly. There are two faint pale clay-colored cross-bars on the back

List of Specimens of Crotaphytus copeii ?

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
637	Magdalena Island.	Mar., 1889.	W. E. Bryant.
638	"	"	"

CALLISAURUS DRACONOIDES Blain.

Callisaurus draconoides.

" 1835, Blainville, Nouv. Ann. Mus., iv, p. 286, pl. xxiv, fig. 2."
1837, Duméril et Bibron, Erpétologie Générale, iv, p. 326.
(1845, Gray, Cat. Lizards Brit. Mus., p. 227.)
1874, Bocourt, Miss. Sci. au Mex., Reptiles, 3e livr., p. 158, pl. xvii bis., figs. 10–10b.
(1893, Stejneger, N. A. Fauna, No. 7, p. 171.)

Callisaurus ventralis.

1859, Baird, Proc. Ac. Nat. Sci. Phila., p. 299.

Callisaurus dracontoides.

(1866, Cope, Proc. Ac. Nat. Sci. Phila., p. 312.)
(1887, Cope, Bull. U. S. Nat. Mus., No. 32, p. 38.)

Callisaurus dracontoides dracontoides.

(1875, Cope, Bull. U. S. Nat. Mus., No. 1, pp. 47, 93.)
1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 50.
(1887, Belding, West Am. Scientist, iii, 24, p. 97.)

The head is broad and low. The snout is rounded when viewed from above, but sharply pointed when seen in profile. The nostrils are large and superior. There is a strongly marked canthus rostralis. The very large interparietal plate is broader than long. There are two or three series of enlarged supraoculars. The other head plates are small and irregular, largest on the frontal and prefontal regions, everywhere very flat and smooth. There is a very long suborbital. The eyelids are heavily fringed. The labials are low, but long, imbricate, and projecting laterally. The infralabials are bordered below by from one to three series of large sublabials. The gulars are granular, smooth, and, except on the central part of the region, longer than wide. The gular fold is covered with imbricate scales, largest at its edge. The back and sides are covered with small flattened granules, which pass gradually into the much larger smooth ventrals. A strong fold extends along each side between the limbs. The tail is of medium length, and considerably depressed at its base. The limbs are very long and slender. The number of femoral pores varies from twelve to eighteen. The males have enlarged postanal plates.

Measurements of the largest specimens in mm.

Sex	♂	♂	♂	♂	♀	♀
Snout to vent	67	68	65	67	60	55
Tail	80	—	—	—	73	62
Head to ear	14	14	14	14	13	12
Width of head	11	12	12	11	11	10
Head to posterior edge of interparietal	12	12	13	13	11	11
Hind limb	62	65	61	62	52	50
Fore limb	36	37	33	35	31	29
Base of 5th to end of 4th toe	27	28	28	27	22	22

There is so much variation in color that no exact description can be given. The males are grayish above, the larger markings on the upper surfaces more distinct than the males, lack the lateral blue blotch and posterior black spot of the males, and have a large bright cadmium orange spot behind the axilla.

This species was first described from a specimen collected by Botta in "California." It was afterwards found by Mr. Xantus at Cape San Lucas, and by Mr. Belding at La Paz.

List of specimens of Callisaurus draconoides.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
605	San José del Cabo, L. C.	Sept. 3, 1890	W. E. Bryant.
729	"	Sept. 16, 1890	"
730	"	"	"
732 to 735	"	Sept. 1, 1890	"
739	"	Sept. 2, 1890	"
740	"	"	"
754	"	"	"
894	"	Sept., 1893	Gustav Eisen.
1400 to 1403	Sierra San Lazaro, L. C.	Sept., 1894	Eisen and Vaslit.
1750 to 1846	San José del Cabo, L. C.	"	"
2212 to 2237	"	1892	W. E. Bryant.
2195	"	Mar., 1892	"

CALLISAURUS VENTRALIS (Hallow.)

Homalosaurus ventralis.

(1852, Hallowell, Proc. Ac. Nat. Sci. Phila., p. 179.)

Callisaurus dracontoides gabbii.

(1875, Cope, Bull. U. S. Nat. Mus., No. 1, p. 47.)

(1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 189.)

Callisaurus dracontoides.
1880, Lockington, Am. Nat., p. 295.
(? 1889, Cope, Proc. U. S. Nat. Mus., p. 147.)
1890, Townsend, Proc. U. S. Nat. Mus., p. 144.
Callisaurus ventralis.
(1893, Stejneger, N. A. Fauna, No. 7, p. 171.)

This more northern species is quite distinct from *C. draconoides* of the "Cape Region," and may be readily distinguished from it by the following characters:

C. ventralis.	*C. draconoides.*
Large.	Small.
Snout short and rounded.	Snout longer and less rounded.
Supralabials prominent and very convex in lateral outline.	Supralabials much less prominent and convex.
Males with two large oblique black blotches on each side.	Males with two smaller almost vertical black blotches, followed by a small black spot.

No intergradation of the two forms has yet been shown, but two young females from San Ignacio, and one from Santa Margarita Island, are more nearly like *C. draconoides* than are any of the other specimens of *C. ventralis*, suggesting, but not showing, an instability of character farther to the south.

The following measurements of *C. ventralis* are given mon on the deserts of the southwestern United States, and of Sonora.

List of specimens of Callisaurus ventralis.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
624 to 627	El Llano de Santano, L. C.	April, 1889.	W. E. Bryant.
628	San Ignacio, L. C.	"	"
629	"	"	"
675	Santa Margarita Island.	Mar. 5, 1889	"

SAUROMALUS HISPIDUS Stejn.

Sauromalus ater.
1877, Streets, Bull. U. S. Nat. Mus., No. 7, p. 36.
?1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 51.
(1887, Cope, Bull. U. S. Nat. Mus., No. 32, p. 35.)
?1887, Belding, West Am. Scientist, iii, 24, pp. 96, 97.
(1890, Townsend, Proc. U. S. Nat. Mus., p. 144.)
Sauromalus hispidus.
1891, Stejneger, Proc. U. S. Nat. Mus., p. 409.
(1893, Stejneger, N. A. Fauna, No. 7, p. 174.)

This species has been found only on Angel de la Guardia Island, Gulf of California. Mr. Belding secured a Sauromalus on Espiritu Santo Island, but it is not known to what species it belongs.

UTA THALASSINA Cope.

Uta thalassina.
1863, Cope, Proc. Ac. Nat. Sci. Phila., p. 104.
(1864, Cope, Proc. Ac. Nat. Sci. Phila., p. 177.)
(1866, Cope, Proc. Ac. Nat. Sci. Phila., p. 312.)
(1875, Cope, Bull. U. S. Nat. Mus., No. 1, pp. 48, 93.)
1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 54.
(1884, S. Garman, Bull. Essex Inst., xvi, 1, p. 16.)
(1887, Cope, Bull. U. S. Nat. Mus., No. 32, p. 35.)
1887, Belding, West Am. Scientist, iii, 24, pp. 96, 98.
1894, Stejneger, Proc. U. S. Nat. Mus., pp. 589, 591.
Petrosaurus thalassinus.
1885, Boulenger, Cat. Lizards Brit. Mus., ii, p. 205.

Description of No. 1472.—The head is flattened, swollen at temples, and with rounded snout. The nostrils are large, superior, and a little nearer to the end of the snout than to the orbit. The large ear opening has a very weak anterior denticulation. The head scales are smooth, and slightly convex anteriorly. The frontal is transversely divided. The largest supraoculars are separated from the frontals, frontoparietals, and parietals, by two series of small plates. The interparietal is very large. There are six superior and seven inferior labials to below the middle of the orbit. Several series of enlarged sublabials pass gradually into the granular gulars which are slightly largest centrally. The first of the two strong gular folds ends in a large pouch at each side. The second is continued as a flap in front of each arm, and is covered with smooth flat plates the largest of which, at its edge, are somewhat larger than the scales on the chest. The back and sides are covered with small smooth round granules, much larger medially than laterally. The tail, conical except where depressed at its base, is covered with whorls of weakly keeled scales, which are a little smaller than those of the belly. The scales of the chest and belly are

One of the brightest individuals, which has been in alcohol little more than a month, may be described thus: On the anterior half of the back are three transverse bands of intense black, bordered posteriorly by others of olivaceous yellow. The first of these bars connects the shoulders. The second is the shortest and narrowest. Near its anterior edge are two round yellow spots, about half the size of the tympanum. The third is the largest and best defined. It is bordered in front by a narrow band of plumbeous, which separates it from another of olivaceous yellow. The remaining space between these black bands is finely dotted and reticulated with black, sepia, and azure. The posterior half of the back is similarly banded, but the colors are here so dull as to appear as if viewed through a thick and discolored epidermis. In front of each shoulder is an azure spot about the size of the tympanum. Half-way between the upper edges of these spots and the tympana are smaller spots of the same color, and others may be seen on the dorsal median line of the neck. The chin and gular regions, except a large central patch of greenish olive (pale turquoise blue in some specimens), are Indian yellow, which color is continued over the sides, and faintly over the back of the neck, just in front of the first black dorsal band. The eyelids and a small area surrounding the pineal "eye" are also yellow. The hind limbs are pale sepia, with indications of seven faint yellowish crossbars. The upper surface of the tail is bluish, greenish, and brownish, crossed by twenty-one broad dark olive or greenish olive bars. The lower surfaces of the tail, limbs, abdomen, and chest, are creamy white, tinged on the chest with olive-green and indian yellow. (In very young individuals there are three transverse greenish bars on a yellow ground.) In the pouches at each end of the middle gular fold are patches of flame scarlet, but close examination shows that this color is due to the presence of multitudes of minute parasites.

Three specimens (smallest, medium, and largest) measure in millimeters as follows:

Total length	**162**	**378**	**(tail reproduced.)**
Snout to vent	**52**	**130**	**154**
Hind limb	**38**	**90**	**95**
Fore limb	**26**	**63**	**67**
Head to ear	**14**	**32**	**36**
Width of head	**11**	**28**	**30**

This beautiful species was originally described from specimens collected by Mr. Xantus at Cape San Lucas. Mr. Belding found it at Playitas, San Lazaro, and in the Victoria Mountains.

List of specimens of Uta thalassina.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
741	San José del Cabo, L. C.	Sept. 1, 1890	W. E. Bryant.
748	San Bartolome, L. C.	Oct., 1890.	"
751	"	"	"
[redacted]	[redacted]	[redacted]	[redacted]

Type.—Cal. Acad. Sci. No. 633, Comondu, Lower California, W. E. Bryant, April, 1889.

Description of the Type.—The head is broad, short, and depressed. The snout is short and truncate. The nostrils are large, superior, and much nearer to the end of the snout than to the orbit. The ear opening is large, and has an anterior denticulation of three pointed scales. The head scales are smooth, and slightly convex anteriorly. The rostral is very broad and low, with a median superior projection. The frontal is transversely divided. The largest supraoculars are separated from the frontals, frontoparietals, and parietals, by two series of small plates. The interparietal is very large. There are five superior and seven inferior labials to below the middle of the eye. There are several series of enlarged sublabials. The gular region is covered with small granules which are slightly largest centrally. There is a weak anterior gular fold followed by a strong posterior fold. The latter is covered with small subgranular plates, the largest of which, on its edge, are about equal in size to the first scales on the chest. The back and sides are covered with round granules, which are larger medially than laterally. The tail is somewhat depressed and expanded at its base, and is covered with whorls of small weakly keeled scales. The scales on the anterior surfaces of the limbs are large and weakly keeled. The ventral plates are larger than the caudals.

The color above is dull grayish olive, with four distinct anterior, and three fainter posterior, transverse black bands. The tail is similarly barred with dusky. The throat is brownish marked with blackish slate centrally. The chest and abdomen are white clouded with slate.

Measurements in mm. of	*Uta repens.*	*Uta thalassina.*	
Snout to vent	**103**	**103**	**95**
Snout to fold	**34**	**35**	**33**
Snout to orbit	**7**	**9**	**8**
Snout to ear	**22**	**24**	**23**
Snout to back of interparietal	**18**	**20**	**19**
Width of head	**18**	**18**	**15**
Fore limb	**45**	**42**	**41**
Hind limb	**62**	**69**	**63**
Base of fifth to end of fourth toe	**22**	**27**	**25**

This species is represented by a single specimen. Its general aspect is very much like that of *U. thalassina*, not at all like *U. mearnsi*.

UTA STANSBURIANA B. and G.

Uta stansburiana.

(1853, Baird & Girard, Stansbury's Report, p. 345, pl. v, figs. 1-6.)
1859, Baird, Proc. Ac. Nat. Sci. Phila., p. 299.
(1864, Cope, Proc. Ac. Nat. Sci. Phila., p. 177.)
(1866, Cope, Proc. Ac. Nat. Sci. Phila., p. 312.)
(1875, Cope, Bull. U. S. Nat. Mus., No. 1, p. 48.)

character, which will separate Lower Californian specimens of this form from specimens collected in California and Arizona. Dr. Yarrow gives no character which will separate them, and, in his Check List, refers specimens from the Cape Region to *U. stansburiana* and *U. elegans* indifferently.

Two specimens from Espiritu Santo Island do not seem to differ from those collected on the peninsula.

Uta stansburiana was first described from the valley of the Great Salt Lake, Utah. *Uta elegans* was established upon specimens collected by Mr. Belding at La Paz. Dr. Streets found the species on Cerros Island; and Mr. Townsend at San Luis Gonzales Bay, San Bartolome Bay, and on Carmen Island in the Gulf of California. Mr. Xantus found it at Cape San Lucas.

List of specimens of Uta stansburiana.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
438	Espiritu Santo Island.	April, 1892	W. E. Bryant.
439	"	"	"
487 to 491	San José del Cabo, L. C.	Mar.10, 1892	"
581	Guadalupe to Colnett, L. C.	Apr.28, 1893	A. W. Anthony.
582	Valladares, L. C.	May 29, 1893	"
585	San Tomas to Guadalupe, L.C.	Apr.27, 1893	"
588	"	"	"
594	Guadalupe to Colnett, L. C.	Apr.28, 1893	"
599	"	"	"
632	Comondu to San Quintin, L.C.	April, 1889	W. E. Bryant.
643	"	"	"
1700 to 1721	San José del Cabo, L. C.	Sept., 1894	Eisen and Vaslit.

UTA PALMERI Stejn.

Uta palmeri.

1890, Stejneger, N. A. Fauna, No. 3, p. 106.

Under this name, Dr. Stejneger has described a Uta from San Pietro Martir Island, Gulf of California. The species belongs to the *U. stansburiana* group.

UTA MICROSCUTATA Van D. Plates viii, figs. F, G, and ix.

Uta microscutata.

1894, Van Denburgh, Proc. Cal. Acad. Sci., Ser. ii, Vol. iv, Part 1, p. 298.

Two specimens from San José Island, in the Gulf of California, have been compared with the type from San Pedro Martir Mountain, Lower California. They differ only in having the bluish white dots on the ventral surfaces more numerous, and the femoral pores eleven and twelve respectively. One is somewhat larger than the type, being 119 mm. in total length. A third specimen, labeled Comondu to San Quintin, is also identical with the type.

List of specimens of Uta microscutata.

Cal. Acad.	Locality.	Date.	Collector.

1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 55.)
(1884, S. Garman, Bull. Essex Inst., xvi, 1, p. 16.)
1885, Boulenger, Cat. Lizards Brit. Mus., ii, p. 212.
(1887, Cope, Bull. U. S. Nat. Mus., No. 32, p. 35.)
(1887, Belding, West Am. Scientist, iii, 24, p. 98.)

There is a very great amount of variation in the size, shape, and number of the head plates, even the frontal being sometimes divided transversely. The largest dorsal scales are along the median line. They are replaced, sometimes gradually and sometimes abruptly, by granules on the sides. Seventeen to twenty-four of the largest dorsals are equal to the length of the head to the posterior edge of the interparietal (occipital) plate. The ventral scales are larger than the dorsals, and perfectly smooth. The caudals are the largest of all, and are very strongly keeled and mucronate. The number of femoral pores ranges from nine to thirteen. The color of the throats of the males varies from canary yellow to deep Chinese orange.

List of specimens af Uta nigricauda.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
621	Magdalena Island, L. C.	1888	W. E. Bryant.
622	"	"	"
673	"	Mar. 12, 1889	"
676 to 679	"	Mar. 11, 1889	"
724	San José del Cabo, L. C.	Sept. 6, 1890	"
737	"	Sept. 2, 1890	"
758	"	Sept. 3, 1890	"
856	"	Oct., 1893	Gustav Eisen.
986	Miraflores, L. C.	"	"
987	"	"	"
1227 to 1358	"	Sept., 1894	Eisen and Vaslit.
1390 to 1399	Sierra San Lazaro, L. C.	"	"
2012 to 2108	San José del Cabo, L. C.	"	"
2191	"	Mar., 1892	W. E. Bryant.

(1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 64.)
(1884, S. Garman, Bull. Essex Inst., xvi, 1, p. 17.)
(1887, Belding, West Am. Scientist, iii, 24, p. 98.)

Sceloporus rufidorsum.
1882, Yarrow, Proc. U. S. Nat. Mus., p. 442.
(1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 64.)
(1887, Belding, West Am. Scientist, iii, 24, pp. 96, 98.)
(1890, Townsend, Proc. U. S. Nat. Mus., p. 144.)

Sceloporus consobrinus.
[1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 61 (part).]
(1887, Belding, West Am. Scientist, iii, 24, p. 98.)

Sceloporus clarki clarki.
[1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 63 (part).]
(1887, Belding, West Am. Scientist, iii, 24, p. 99.)

This very distinct species belongs to the *S. magister* group. Specimens from the northern part of the peninsula and from several of the neighboring islands seem to be like those from the "Cape Region" in all respects. The following table may be useful for comparison with other species:

Cal. Acad. Sci. No.	Sex.	No. of scales on back.	Scales equal shielded part of head.	Femoral pores.	Measurements in mm.					Locality.
					Snout to vent.	Tail.	Hind limb.	Fore limb.	Shielded part of head.	
630	♂	29	6	19	106	143	73	48	20	San Pablo.
666	♂	28	6	22	106	148	78	49	21	Magdalena Island.
665	♂	30	5	19	104	141	78	51	20	"
664	♀	29	5	18	95	121	65	44	18	Sta. Margarita Island.
663	♀	29	5	18	93	126	70	46	18	"
437	♂	30	5	19	100	135	71	48	19	San José Island.
1691	♂	30	5	20	93	—	66	42	18	San José del Cabo.
1690	♂	29	5	19	83	—	62	40	17	"
1688	♂	29	5	20	99	—	66	43	18	"
1686	♀	30	6	18	74	107	57	38	15	"

Sceloporus zosteromus is not confined to the "Cape Region" of Lower California. It has been recorded from Cape San Lucas (type locality), La Paz, Cerros Island, and San Quintin Bay (the type locality of S. *rufidorsum)*. The present collection contains specimens from San José Island, San Pablo, Santa Margarita Island, Miraflores, Magdalena Island, and San José del Cabo.

List of specimens of Sceloporus zosteromus.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
436	San José Island, L. C.	April, 1892	W. E. Bryant.
437	"	May, 1892	"
539	San José del Cabo, L. C.	April, 1892	Gustav Eisen.
604	"	Sept. 3, 1890	W. E. Bryant.
608	"	"	"
609	"	"	"
630	San Pablo, L. C.	April, 1889	"
641	Magdalena Island ?	Mar., 1889	"
663	Santa Margarita Island.	Mar. 1, 1889	"
664	"	"	"
665	Magdalena Island, L. C.	Mar. 11, 1889	"
666	"	"	"
667	"	"	"
668	"	Feb. 25, 1889	"
669	"	"	"
670	"	"	"
671	"	Mar. 11, 1889	"

the back, with much larger scales on the posterior surface of thigh, and never with two blue patches on throat.

Type.—Cal. Acad. Sci. No. 1436, Sierra San Lazaro, Lower California, Eisen and Vaslit, Sept., 1894.

Description of the Type.—The head is considerably depressed, with rounded snout. There are two scales on the canthus rostralis. The nostrils are large, almost superior, and nearer to the end of the snout than to the orbit. The ear opening is very large, almost vertical, and with a strong anterior denticulation of six pointed scales. The head shields are smooth and somewhat convex. The supraoculars are very broad. The superciliaries are very long, narrow, and strongly imbricate. There are two series of small, and one of large, sublabial plates, bordered below by the large, imbricate, bicuspid gulars. There is a strong fold on each side of the neck. The dorsal scales are slightly smaller than the caudals, strongly keeled, very strongly mucronate, and with serrate edges. The lateral scales are similar to, but smaller than, the dorsals, arranged in oblique series, and graduating into the dorsals and ventrals. The ventrals are much smaller than the dorsals, smooth, and bi- or tricuspid. The caudals are very strongly keeled and mucronate. The posterior surface of the thigh is covered with large, pointed, keeled scales. There are fifteen femoral pores. Male, with enlarged postanal plates. There are thirty-three dorsal scales between the interparietal plate and the base of the tail.

The back and sides are olive brown, many of the scales having central markings of deep blue or green. A narrow line of verdigris green runs along each side from the eye to the base of the tail. Below this, a narrower similarly colored line runs from the ear to a point a short distance above and behind the axilla. A patch in front of the shoulder, the central part of the belly, and the anterior and lower surfaces of the thigh, are black, which color gradually fades into the cyanine blue of the sides of the belly. The throat is olive gray with greenish white lines which converge to a point midway between the neck pouches. The tail is brown suffused with campanula blue and beryl green towards its base.

Snout to vent 74 mm. Fore limb 37 mm. Tail 105 mm. Shielded part of head, 15 mm. Hind limb 54 mm. Base of 5th to end of 4th toe 22 mm.

Variation.—There is very little variation in color, either individual, sexual, or in accordance with age. One male from Miraflores has a single large blue patch on the throat, through which the ordinarily whitish lines show as lines of paler blue.

The following table will serve to show the variation in structural characters:

Acad. Sci. No.		es on back.	es equal shielded part of head.	of scales in ear denticulation.	oral pores.	Measurements in mm.					
						ut to vent.		d limb.	limb.	lded part of head.	e of 5th to end of 4th toe.

The next table shows the same characters of *Sceloporus consobrinus:*[*]

U. S. Nat. Mus. No.	Sex.	Scales on back.	Scales equal the shielded part of head.	Scales in ear denticulation.	Femoral pores.	Measurements in mm.						Locality.
						Snout to vent.	Tail.	Hind limb.	Fore limb.	Shielded part of head.	Base of 5th to end of 4th toe.	
15697	♂	39	8	5	18	62	—	48	31	13	20	Prescott, Ariz.
15696	♀	39	9	4	15	58	86	44	28	12	18	"
15695	♀	41	10	5	18	55	—	39	25	12	16	"
17235	♀	41	7	5	16	67	98	45	28	13	19	Tucson, Ariz.
17234	♂	38	8	5	17	54	91	43	28	12	18	"
16958	♂	39	8	5	17	65	95	45	27	13	18	"
16959	♂	—	8	5	16	—	103	47	28	13	20	"
16960	♀	38	9	5	14	46	—	32	21	10	14	"
2895	♂	—	9	5	14	48	62	30	20	10	12	Nebraska.
2895	♀	40	8	4	14	63	80	37	26	13	15	"
2895	♂	42	9	4	15	45	—	30	19	10	13	"
8163	♀	47	9	5	13	—	—	42	27	12	17	Utah.
8163	♂	43	9	4	13	61	—	43	28	12	18	"
8491	♀	45	10	5	18	63	—	41	27	13	17	New Mexico.
8491	♂	46	10	5	16	49	—	34	23	10	14	"

Comparison.—This species may be easily distinguished from *S. consobrinus* by its larger scales on the back of the thigh; from *S. biseriatus* by its larger scales on the border of the ear and the back of the thigh; from *S. orcutti* by its smaller and much rougher dorsals; and from *S. magister* and *S. zosteromus* by its smaller and more sharply mucronate scales. It differs from all these in coloration.

This species is named in honor of Mr. James Lick, who has done so much to foster Science in California.

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[*] I am greatly indebted to Dr. Leonhard Stejneger for the opportunity to examine these specimens.

List of specimens of Sceloporus licki.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
731	San José del Cabo, L. C.	Sept. 16, 1890	W. E. Bryant.
979	Corral de Piedras, Sierra El Taste, L. C.	Sept., 1893	Gustav Eisen.
1152 to 1168	Miraflores, L. C.	Sept., 1894	Eisen and Vaslit.
1409 to 1413	Sierra San Lazaro, L. C.	"	"
1415 to 1437	"	"	"
1439	"	"	"

SCELOPORUS BISERIATUS Hallow.

Sceloporus biseriatus.
(1854, Hallowell, Proc. Ac. Nat. Sci. Phila., p. 93.)

Specimens of this species from northern Lower California do not seem to differ from Californian ones.

List of specimens of Sceloporus biseriatus.

Cal. Acad.	Locality	Date	Collector

List of specimens of Sceloporus graciosus.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
584	San Pedro Martir Mt., L. C.	May, 1893.	A. W. Anthony.
586	"	May 12, 1893	"
587	"	May, 1893.	"
590	"	May 11, 1893	"
591	"		"
592	"		"

PHRYNOSOMA SOLARE Gray.

Phrynosoma solaris.

(1845, Gray, Cat. Lizards Brit. Mus., p. 229.)
(1894, Van Denburgh, Proc. Cal. Acad. Sci., Ser. 2, Vol. iv, Pt. 1, p. 456.)

Phrynosoma regale.

1880, Lockington, Am. Nat., p. 295.

The Academy has one specimen (No. 90) from Las Animas Bay, Lower California, the locality from which Mr. Lockington has recorded the species.

PHRYNOSOMA CORONATUM Blainv.

Phrynosoma coronatum.

" 1835, Blainville, Nouv. Ann. Mus., iv, p. 284, pl. xxv, figs. 1-1c."
1837, Duméril et Bibron, Erpétologie Générale, iv, p. 318.
1870, Bocourt, Miss. Sci. au Mex., Reptiles, 1e livr., pl. xii, fig. 10.
1874, Bocourt, Miss. Sci. au Mex., Reptiles, 4e livr., p. 239 (part).
(1866, Cope, Proc. Ac. Nat. Sci. Phila., p. 312.)
(1875, Cope, Bull. U. S. Nat. Mus., No. 1, pp. 50, 93.)
[1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 70 (part).]
(1887, Cope, Bull. U. S. Nat. Mus., No. 32, p. 39).
1893, Stejneger, N. A. Fauna, No. 7, p. 187.
1894, Van Denburgh, Proc. Cal. Acad. Sci., Ser. 2, Vol. iv, Pt. 1, p. 296.

Phrynosoma ———

1859, Baird, Proc. Ac. Nat. Sci. Phila., p. 299.

Phrynosoma cornutum.
1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, pp. 66, 67, (part).
(1887, Belding, West Am. Scientist, iii, 24, p. 98.)
1893, Stejneger, N. A. Fauna, No. 7, pl. ii, figs. 1-1c.
Phrynosoma asio.
(1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 67.)
[1885, Boulenger, Cat. Lizards, Brit. Mus., ii, p. 244 (part).]
(1887, Belding, West Am. Scientist, iii, 24, p. 98.)
Phrynosoma hernandezi.
[1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 68 (part).]

The nostrils are pierced in the lines joining the superciliary ridges with the end of the snout. There are several longitudinal series of large pointed gular scales, the exterior of which are continued back upon the gular folds. There is a series of five very large pointed sublabial plates. The head spines are very large. They are four temporals, one occipital and one postorbital, on each side, and one large interoccipital. Occasionally small spines are developed between the temporals. Below the rictus is a broad spine usually without any, but sometimes with a very small, spine behind it. There is a row of four or five spinose scales in front of the occipital spines. The other head scales, with few exceptions, are shorter than the distance from the axilla to the front of the thigh, but those of the males are considerably longer than this distance. The young of both sexes have short tails. The color above is brownish, yellowish or grayish, darker laterally. There is a large brown patch on each side of the neck and a series of three more or less distinct brown bars on each side of the back. These bars are light bordered posteriorly. The tail is transversely banded with brown. The belly is often dotted or blotched with black or brown. All these markings are more distinct in the young. The larger dorsal tubercles are often tipped with orange-rufous, and those on each side of the median line have seal brown or black keels. The occipital spines are ribbed with very dark brown. The temporals are yellow tinged with rufous. In very young individuals the scales of the vertex are grayish or yellowish white, with a few minute brown or black spots. These spots, which are on the raised portions of the scales, become more numerous as the animals increase in size, until the whole crown appears black or dark brown crossed by irregular lines formed by the yellow posterior edges of the scales.

Phrynosoma coronatum was first described from a specimen collected by Botta in "California." It has since been recorded from Cape San Lucas, and La Paz. The specimens enumerated below show that it ranges far north of the limits of the "Cape Region."

List of specimens of Phrynosoma coronatum.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
645 to 649	Comondu to San Quintin, L.C.	April, 1889	W. E. Bryant.
659	Poso Grande, L. C.	Mar. 18, 1889	"
660	"	Mar. 20, 1889	"
719	San José del Cabo, L. C.	Sept. 7, 1890	"
720	"	"	"
721	"	"	"
722	"	Sept. 6, 1890	"
723	"	"	"
862	"	Oct., 1893	Gustav Eisen.
863	"	"	"
864	"	"	"
901	"	"	"
902	"	"	"
903	"	Jan. 25, 1893	"
904	San Francisquito, Sierra Laguna, L. C.	Mar. 28, 1892	"
905	San José del Cabo, L. C.	Nov., 1893	"
906	"	"	"
907	"	"	"
908	"	"	"

This species has been found as far south as San Tomas, in the northern part of the peninsula.

A key to the North American species of the *Ph. coronatum* group [*] is given.

I.—A long spine just behind the broad subrictal. Head plates of adults yellow, sparsely dotted with brown.

A.—Head plates convex and almost smooth. *Ph. blainvillii* Gray.

B.—Head plates flat and rugose. *Ph. frontale* Van D.

II.—No spine, or a very small one, behind the broad subrictal. Head plates, of adults, chiefly black or dark brown.

Ph. coronatum Blainv.

The present collection contains a single specimen of this species. It (No. 579) was secured by Mr. A. W. Anthony, at Valladares, L. C.

PHRYNOSOMA CERROENSE Stejn.

Phrynosoma cerroense.

1893, Stejneger, N. A. Fauna, No. 7, p. 187.

This species, from Cerros Island, is characterized by having the lower row of peripheral spines "only indicated by a few scattered small spines."

GERRHONOTUS MULTICARINATUS Blainv.

Gerrhonotus multicarinatus.

" 1835, Blainville, Nouv. Ann. Mus., iv, p. 289, pl. xxv, fig. 2."
1839, Duméril et Bibron, Erpétologie Générale, v, p. 404.
1866, Cope, Proc. Ac. Nat. Sci. Phila., p. 312.
[1875, Cope, Bull. U. S. Nat. Mus., No. 1, p. 46 (part).]
1878, Bocourt, Miss. Sci. au Mex., Reptiles, 5e livr., p. 357, pl. xxi c, fig. 5-5a.
1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 47 (part).
[1887, Cope, Bull. U. S. Nat. Mus., No. 32, p. 41 (part).]
(1887, Belding, West Am. Scientist, iii, 24, p. 97).
1893, Stejneger, N. A. Fauna, No. 7, p. 195.

Without larger series of the other species than are at hand, the status of the *Gerrhonoti* from the "Cape Region" of Lower California cannot be satisfactorily determined.

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[*] Not including the insular *Ph. cerroense.*

It seems probable, however, that they are distinct from the more northern *G. scincicauda*, and are referable to the name *G. multicarinatus* Blainv.

The type of *G. multicarinatus* is one of the specimens collected by Botta in "California." Mr. Belding found the species at La Paz.

List of specimens of Gerrhonotus multicarinatus.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
536	San José del Cabo, L. C.		Gustav Eisen.
869	"	Oct., 1893	"
874	"	Aug., 1893	"
884	"	July, 1893	"
980	Corral de Piedras, Sierra El Taste, L. C.	Sept., 1893	"
981	"	"	"
982	"	"	"
983	Sierra El Taste, L. C.	"	"
984	"	"	"
1387	Sierra San Lazaro, L. C.	Sept., 1894	Eisen and Vaslit.
1388	"	"	"
1619	San José del Cabo, L. C.	"	"

List of specimens of Gerrhonotus scincicauda.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
580	San Pedro Martir Mt., L. C.	May 4, 1893	A. W. Anthony.
598	Valladares?, L. C.	May 29, 1893	"

XANTUSIA GILBERTI new species. Plate xi.

Diagnosis.—Similar to *X. vigilis*, but with smaller eye, two plates occupying the position of the frontal of that species, and the interfrontonasal larger and continued posteriorly to completely separate the frontonasals.

Type.—Cal. Acad. Sci. No. 401, San Francisquito, Sierra Laguna, Lower California, Gustav Eisen, March 28, 1892.

Description of the Type.—The eye is very small, without lids, and with vertical pupil. The nostrils are pierced at the junction of the rostral, internasal, first superior labial, and first loreal plates. There are three loreals, increasing in size posteriorly. There are two internasals. The two frontonasals are separated by the interfrontonasal, which is in contact, also, with the two frontal plates. The other head plates are two frontoparietals, two parietals, two large occipitals, and one interparietal. The eye is surrounded by a ring of small scales, of which the superciliaries are largest. This ring is separated from the third loreal by two small scales. There are eight superior and eight inferior labials. The anterior border of the ear is slightly denticulate. The ventral plates are arranged in thirty-two transverse and ten or twelve longitudinal series. The caudal scales are smooth, convex, and in whorls of about equal length. The back and sides are covered with smooth convex granules of about uniform size. There are eight and nine femoral pores. The gular regions are covered with smooth, flattened, subhexagonal granules which are slightly larger than those on the back and sides.

The color above is dark brownish clay, dotted with black on single granules. A pale yellowish line, two granules wide, runs posteriorly from each occipital plate, but is soon lost on the back to reappear over the thigh.

Length to vent (about) 39 mm. Tail (about) 38 mm. Hind limb 14 mm. Fore limb 10 mm. Diameter of eye 1+ mm. Shielded part of head 8½ mm. Head to posterior edge of ear 8½ mm. Head to anterior gular fold 7¼ mm. Head to posterior edge of anterior fold 11¼ mm. Head to posterior edge of posterior fold 12¾ mm.

The single specimen of *X. gilberti* has been compared with one hundred and forty-four of *X. vigilis* without any approach to its distinctive characters having been found. It is of great interest, for it extends the known range of the genus *Xantusia* several hundred miles to the southward, introducing it for the first time into Mexican territory, and affording another link between the "Cape Region" and the Sonoran Subprovince.

It gives me great pleasure to name this interesting lizard in honor of Dr. Charles H. Gilbert, to whom my in-top of the snout. The posterior nasal forms sutures with the anterior nasal, first second and third labials, loreal, prefrontal, and frontonasal plates. The loreal is in contact with the third and fourth labials, first subocular, preocular, first superciliary, first supraocular, prefrontal, and anterior nasal. There are four supraoculars; the first, long and narrow, the fourth rather small. The second, third, and fourth supraoculars are separated from the superciliaries, and the third and fourth from the frontoparietal and parietal, by small convex granules. There are two transverse rows of small plates behind the parietals and interparietal. There are five superior and six inferior labials to below the middle of the eye. The sublabials are very large and are separated from the infralabials by a series of small granules and plates. The anterior gulars are large centrally, become gradually smaller laterally, and are abruptly separated from the medium sized posterior gulars. The central scales of the collar are quite large, those on its edge, smaller. The back is covered with small uniform granules. There are eight longitudinal and thirty-seven transverse rows of ventral plates, and four series of large preanals. There are seven rows of brachials, three of antebrachials, seven of femorals, and four of tibials, but no postantebrachials. The tail is covered with whorls of obliquely keeled scales. There are twenty-three and twenty-four femoral pores.

The color above is grayish sepia fading to olive gray laterally, with three longitudinal dark chestnut bands on each side, which (bands) are twice as wide as the intervals between them, and are so invaded by spots of the ground color, as to resemble series of confluent brown maculations. The limbs are reticulated with coarse chestnut lines. The upper surface of the head is olive, palest on the snout. The gular region and the sides of the head are blotched with walnut brown. Many of the ventral plates have black basal markings. The tail is tawny olive, tinged and spotted with dark chestnut.

Snout to vent 131 mm. Tail (regrown) 302 mm. Hind limb 87 mm. Fore limb 48 mm. Snout to ear 30 mm. Greatest width of head 19 mm. Snout to edge of collar 41 mm.

Young.—Young individuals have five bluish white longitudinal lines on a black ground which is more or less broken by spots of the same color as the lines. Their tails and hind limbs are suffused with bright flesh color. In one there are six instead of five pale lines.

Variation.—The femoral pores vary in number from twenty to twenty-six. The scales of the collar are sometimes largest at its edge. The general ground color is at times quite gray, and the dark markings often more or less obsolete, particularly on the anterior part of the body. The number of plates on the limbs is very variable.

List of specimens of Cnemidophorus maximus.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
108	Lower California.		W. J. Fisher.
705	San José del Cabo, L. C.	Sept. 1, 1890	W. E. Bryant.
706	“	“	“
715	“	Sept. 9, 1890	“
742	“	Sept., 1890	“
834 to 843	“	Sept., 1893	Gustav Eisen.
1096 to 1119	Miraflores, L. C.	Sept., 1894	Eisen and Vaslit.
1171 to 1179	“	“	“
1438	Sierra San Lazaro, L. C.	“	“
1440 to 1451	“	“	“
1670 to 1677	San José del Cabo, L. C.	“	“
2194	“	March, 1892	W. E. Bryant.
2198	“	“	Gustav Eisen.
2193	“	“	W. E. Bryant.
2241	“	“	“

CNEMIDOPHORUS MARTYRIS Stejn.

Cnemidophorus martyris.

1891, Stejneger, Proc. U. S. Nat. Mus., p. 407.

(1892, Cope, Trans. Am. Philos. Soc., xvii, 1, p. 36.)

This species has been described by Dr. Stejneger from two specimens taken on San Pedro Martir Island, Gulf of California.

It is most closely allied to *C. melanostethus* Cope, but has the blackish suffusion extended over the entire lower surface.

CNEMIDOPHORUS MULTISCUTATUS (Cope).

Cnemidophorus tessellatus melanostethus.
[?1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 45 (part).]
?1887, Belding, West Am. Sci., iii, 24, p. 99.
Cnemidophorus tessellatus tigris.
(1889, Cope, Proc. U. S. Nat. Mus., p. 147.)
Cnemidophorus tessellatus multiscutatus.
1892, Cope, Trans. Am. Philos. Soc., xvii, 1, p. 38.

Prof. Cope has proposed this name for specimens from Cerros Island, characterized by the large number of brachial (7 to 8 rows) and femoral (8 to 9 rows) plates.

CNEMIDOPHORUS STEJNEGERI Van D.

Cnemidophorus tessellatus tessellatus.
?1880, Lockington, Am. Nat., xiv, 4, p. 295.
(?1889, Cope, Proc. U. S. Nat. Mus., p. 147.)
[?1892, Cope, Trans. Am. Philos. Soc., xvii, 1, p. 34 (part).]
Cnemidophorus stejnegeri.
1894, Van Denburgh, Proc. Cal. Acad. Sci., Ser. 2, Vol. iv, Pt. 1, p. 300.

There are two specimens of this species in the present collection. One (No. 642) was obtained by Mr. Bryant and labeled Comondu to San Quintin, L. C. The other (No. 597) was secured by Mr. Anthony and is labeled Lower California.

superior and five inferior labial plates to below the middle of the orbit. The infralabials are separated from the large sublabials by a series of granules. The gular scales are rather large centrally, and the posterior part of the region is not very distinct from the anterior. The scales on the collar are of medium size, largest centrally, small at edge, and in about seven transverse rows. There are no large postantebrachials. The caudal scales are large and provided with prominent diagonal keels. There are twenty femoral pores.

The color above is brownish olive, paler on the sides, overlaid with tawny olive posteriorly, and crossed by narrow transverse black bands. The posterior six of these bands extend entirely across the back, but the others are interrupted, forming a dorsal series of black spots, with corresponding vertical bars upon the sides. The black markings on the neck are reduced to six longitudinal series of more or less obsolete spots. The posterior limbs are faintly reticulated with black, and illuminated with numerous white spots above and posteriorly. The inferior surfaces of the limbs are deep flesh color, with a slightly purplish tinge. This color appears, also, on the gular region, about the ears, and on the lower surface of the tail. There are no large or distinct markings on the gular region.

Snout to vent 100 mm. Snout to ear 23 mm. Fore limb 36 mm. Width of head 17 mm. Hind limb 69 mm. Snout to edge of color 33 mm.

This name was established upon seven specimens from Santa Margarita Island. The present collection contains one from Magdalena Island, and two fine adults from Comondu on the peninsula, thus greatly increasing the known range of the species. The Magdalena specimen is much smaller than those from Comondu, and differs from them in the presence of small, well defined black blotches on the gular region. Professor Cope is not followed in his use of a trinomial because no intergradation of this with other forms has been shown.

List of specimens of Cnemidophorus rubidus.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
661	Comoudu, L. C.	Mar. 22, 1889	W. E. Bryant.
662	"	"	"
674	Magdalena Island, L. C.	Mar., 1889	"

CNEMIDOPHORUS LABIALIS Stejn.

Cnemidophorus labialis.
1889, Stejneger, Proc. U. S. Nat. Mus., p. 643.
(1892, Cope, Trans. Am. Philos. Soc., xvii, 1, p. 51.)

This species has been found only on Cerros Island.

VERTICARIA HYPERYTHRA Cope.

Cnemidophorus hyperythrus.
1863, Cope, Proc. Ac. Nat. Sci. Phila., p. 103.
(1866, Cope, Proc. Ac. Nat. Sci. Phila., p. 312.)
(1885, Boulenger, Cat. Lizards Brit. Mus., ii, p. 371.)

first supraocular, prefrontal, and posterior nasal, plates. There are four supraoculars; the first is in contact with the first superciliary, loreal, prefrontal, frontal and second supraocular; the second touches the frontal; the third forms sutures with the frontal and frontoparietal; the fourth is separated from the parietal by a series of granules. The frontoparietal is more than half as large as the frontal. There is a transverse row of small occipital plates. The sublabials are separated from the infralabials by granules. There are five superior and five inferior labials to below the middle of the eye. The ear opening is not denticulated. The anterior gulars are quite large, and abruptly separated from the small posterior granules. The scales on the collar are very large, largest on its edge. The ventral plates are in thirty transverse, and eight longitudinal rows. The back and sides are covered with small equal sized granules. The tail is somewhat flattened at its base, and is covered with whorls of diagonally keeled scales. The lower caudals are smooth. The hind limb is as long as the distance between the anus and the front of the collar. There are fourteen and fifteen femoral pores.

The plates on the head are pale olive. There are two narrow longitudinal wood brown lines on the back, separated by an area of sepia. The sides are dark olive with two bluish white longitudinal lines, The upper, of these lateral lines, arises on the superciliary plates and is continued for some distance on the tail. The lower originates on the posterior nasal plate, and ends on the thigh. A light stripe on the back of the thigh is continued along the tail. The first and half of the second longitudinal rows of ventral plates are grayish pale blue. The entire lower surface, except of the hind limbs, is reddish orange-crome.

Snout to vent 61 mm. Snout to ear 14 mm. Hind limb 42 mm. Anus to gular fold 41 mm. Fore limb 19 mm. Anus to anterior gulars 47 mm. Width of head 9 mm.

The types of this species were collected at Cape San Lucas, by Mr. John Xantus. Mr. Belding secured others at La Paz.

List of specimens of Verticaria hyperythra.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
451	San José del Cabo, L. C.	April, 1892	Gustav Eisen.
452	"	"	"
534	"	Sept.20, 1890	W. E. Bryant.
606	"	Sept. 3, 1890	"
607	"	"	"
611	"	Sept. 1, 1890	"
725	"	Sept. 6, 1890	"
726	"	Sept. 1, 1890	"
727	"	"	"
728	"	Sept.16, 1890	"
743	"	Sept., 1890	"
[redacted]	[redacted]	[redacted]	[redacted]

VERTICARIA HYPERYTHRA BELDINGI (Stejn.)

Verticaria beldingi.

1894, Stejneger, Proc. U. S. Nat. Mus., p. 17.

Ninety-eight Verticarias from the "Cape Region" of Lower California, and thirty-eight (including one of the specimens upon which *V. beldingi* was established) from northern Lower California and San Diego County, California, have been examined with a view to determining the status of this form. The character originally depended upon for the distinction of *V. beldingi* from *V. hyperythra*, viz., the small size of the scales on the collar in *V. beldingi*, was found to be valueless, since many of the northern specimens have these scales as large as in individuals collected near Cape San Lucas, and since much individual variation exists in both. There appears to be not even an average difference, in this respect, between the northern and southern forms. The difference in the extent to which granules intrude between the supraoculars and the large medial head plates, seems, however, to present a good average distinction between the two forms, as is shown in the following table:

	Number of Specimens of	
	hyperythra.	*beldingi.*
Second supraocular separated from median head scales	3	20
Second supraocular partly separated	5	15
Third supraocular separated	8	0
Third supraocular partly separated	82	3
Total number examined	98	38

As this difference is merely an average one, it becomes necessary to regard *V. beldingi* as a subspecies of *V. hyperythra*. A trinomial is therefore used.

The type of this form came from Cerros Island.

List of specimens of Verticaria hyperythra beldingi.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
639	Magdalena Island, L. C.	Mar., 1889	W. E. Bryant.
680	"	Mar. 11, 1889	"
681	"	"	"

VERTICARIA SERICEA, new species. Plate xii.

Diagnosis.—Hind limb relatively much longer, and scales on collar, especially on its edge, much smaller, than in *V. hyperythra* and *V. hyperythra beldingi.* A single median dorsal line, as light distinct and well defined as the lateral ones, instead of two faint brownish lines as in *V. hyperythra* and *V. hyperythra beldingi.*

Type.—Cal. Acad. Sci. No. 435, San José Island, Gulf of California, Walter E. Bryant, April, 1892.

Description of the Type.—The nostrils are in the large anterior nasal plates, which meet on top of the snout.

denticulated. The sublabials are separated from the infralabials by granules. The anterior gulars are rather large; and abruptly separated from the small posterior gulars. The scales on the collar are very small, largest centrally, smaller on edge. The ventral plates are arranged in eight longitudinal and thirty transverse rows. The back is covered with small equal-sized granules. The conical tail is provided with scales arranged in whorls. The upper caudals have strong diagonal keels, but the lower are smooth. There are sixteen femoral pores. The hind limb is longer than the distance between the anus and the line of separation of the anterior and posterior gulars.

The back is clove brown, dotted with gray on single granules posteriorly, with a median bluish white line which bifurcates on the neck about a fourth of an inch behind the occipital plates. There are two similar lines on each side; the first originating on the superciliaries and with a faint continuation on the tail; the second starting at the nostril and ending on the thigh. The ground color of the sides is much paler than in *V. hyperythra*, being pale sepia. The general tint of the tail is hair brown above, pale blue below. The ventral and sublabial plates, the chin, gular region, and collar, are all pale blue.

Length to anus 54 mm. Hind limb 44 mm. Fore limb 22 mm. Head to ear 13 mm. Anus to gular fold 36 mm. Anus to anterior gulars 42 mm. Width of head 8 mm.

The single specimen of *Verticaria sericea* has been compared with ninety-eight of *Verticaria hyperythra* and thirty-eight of *Verticaria hyperythra beldingi*, without any approach to its distinctive characters having been found.

EUMECES LAGUNENSIS, new species. Plate xiii.

Eumeces skiltonianus.
?1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 41.
(?1887, Belding, West Am. Scientist, iii, 24, p. 99.)

Diagnosis.—Similar to *E. skiltonianus*, but tail salmon color instead of blue, and with interparietal smaller than either frontoparietal instead of larger.

Type.—Cal. Acad. Sci. No. 400, San Francisquito, Sierra Laguna, Gustav Eisen, March 28, 1892.

Description of the Type.—The nasal is small, in contact with the internasal, postnasal, first labial, and rostral plates. The postnasal touches the nasal, internasal, anterior loreal, and the first and second labials. The anterior loreal forms sutures with the postnasal, internasal, frontonasal, prefrontal, second loreal, and second and third labials. The three anterior of the four supraoculars are in contact with the frontal. The interparietal is smaller than either of the frontoparietals. The parietals are in contact posteriorly. The last of the seven labials is largest. There are two azygos postmentals. The limbs overlap when pressed against the body. There are twenty-four longitudinal rows of scales. The dorsal scales are larger lower surfaces of the limbs, and the proximal half of the tail, are dull pinkish buff. The belly and a faint bar across the throat, are bluish gray. The tail is salmon or bright flesh color, marked, except on its terminal fourth, with three narrow poorly defined lines of slaty heliotrope, in continuation of the olive ground color of the back.

Snout to vent 52 mm. Tail (about) 95 mm. Hind limb 18 mm. Fore limb 14 mm. Head to posterior edge of ear 10 mm.

List of specimens of Eumeces lagunensis.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
400	San Francisquito, Sierra Laguna, L. C.	Mar. 28, 1892	Gustav Eisen.
402	"	"	"

EUCHIROTES BIPORUS Cope.

Chirotes canaliculatus.

1877, Streets, Bull. U. S. Nat. Mus., No. 7, p. 37.
(1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 38.)
1887, Cope, Bull. U. S. Nat. Mus., No. 32, p. 47.
(1887, Belding, West Am. Scientist, iii, 24, p. 97.)

Chirotes sp.?

(1880, Lockington, Am. Nat., p. 295.)

Euchirotes biporus.

1894, Cope, Am. Nat., p. 437, figs. 5–5e.

The snout is short, rounded and very convex. The limbs are very broad and short, with five perfect clawed digits. The larger head plates are a rostral, three labials, a nasal, an ocular, a preocular, two suboculars, one supraocular, a very large prefrontal, and a pair of frontals. There are also two small plates between the third labial and the suboculars. The anus is preceded by several rows of granules, in front of which is a transverse series of six large plates. There is a single preanal pore in a large plate in front of the external preanal plate of each side.

Total length 199 mm. Limb 8 mm. Tail 18 mm. Head 7 mm.

The Academy has a single specimen (No. 128) from La Paz. The type came from Cape San Lucas.

RENA HUMILIS B. and G.

Rena humilis.
    (1853, Baird and Girard, Cat. N. A. Reptiles, i, Serpents, p. 143.)
    (1887, Cope, Bull. U. S. Nat. Mus., No. 32, p. 64.)
    (1891, Stejneger, Proc. U. S. Nat. Mus., 1891, p. 501.)
    (1892, Cope, Proc. U. S. Nat. Mus., 1891, p. 590.)
Stenostoma humile.
    1861, Cope, Proc. Ac. Nat. Sci. Phila., p. 305.
    1882, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 142.
    (1887, Belding, West Am. Scientist, iii, No. 24, p. 98.)
Glauconia humilis.
    (1893, Boulenger, Cat. Snakes Brit. Mus., i, p. 70.)

The twenty-three Lower Californian specimens of this curious little reptile in the Academy's collection are all from the "Cape Region." They show that the species lives both in the mountains, and at the level of the sea.

There is very little variation in color. The lower parts are creamy white, the upper (five to seven rows of scales)

List of specimens of Rena humilis.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
447 to 450	San José del Cabo, L. C.		Gustav Eisen.
469	"	March, 1892	"
817 to 821	"	Sept., 1893	"
823 to 826	"	"	"
880	"	May, 1893	"
881	"	"	"
882	"	"	"
883	"	July, 1893	"
1547	"	Sept., 1894	Eisen and Vaslit.
1629	"	"	"
822	"	Sept., 1893	Gustav Eisen.
2200	San Francisquito, Sierra Laguna, L. C.	Mar. 28, 1892	"
2201	"	"	"

LICHANURA TRIVIRGATA Cope.

Lichanura trivirgata.

1861, Cope, Proc. Ac. Nat. Sci. Phila., p. 304.
" 1865, Jan, Iconogr. génér. Oph., 2e livr., pp. 69, 70."
(1875, Cope, Bull. U. S. Nat. Mus., No. 1, pp. 43, 93.)
(1882, Bocourt, Miss. Sci. au Mex., Reptiles, 8e livr., p. 514.)
1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 142.
(1887, Belding, West. Am. Scientist, iii, No. 24, p. 98.)
(1887, Cope, Bull. U. S. Nat. Mus., No. 32, p. 65.)
1889, Stejneger, Proc. U. S. Nat. Mus., p. 98, fig. 3.
1891, Stejneger, Proc. U. S. Nat. Mus., pp. 512, 514, 515.
(1892, Cope, Proc. U. S. Nat. Mus., 1891, p. 591.)
[1893, Boulenger, Cat. Snakes, Brit. Mus., i, p. 129 (part).]

Charina trivirgata.

(1883, S. Garman, Mem. Mus. Comp. Zool., viii, 3, pp. 8, 131.)
(1884, S. Garman, Bull. Essex Inst., xvi, 1, p. 22.)

The Academy's collectors have failed to find this snake, which seems to be a very distinct species.

The types were collected, by Mr. Xantus, in swamps among the mountains near Cape San Lucas. Mr. Belding obtained an individual near La Paz.

LICHANURA ROSEOFUSCA Cope.

Lichanura roseofusca.

1868, Cope, Proc. Ac. Nat. Sci. Phila., p. 2.
(1875, Cope, Bull. U. S. Nat. Mus., No. 1, p. 43.)
(1887, Cope, Bull. U. S. Nat. Mus., No. 32, p. 65.)
(1889, Stejneger, Proc. U. S. Nat. Mus., pp. 94, 97, 98.)
1891, Stejneger, Proc. U. S. Nat. Mus., pp. 512–515.)
(1891, Cope, Proc. U. S. Nat. Mus., p. 591.)

Lichanura myriolepis.

1868, Cope, Proc. Ac. Nat. Sci. Phila., p. 2.
(1875, Cope, Bull. U. S. Nat. Mus., No. 1, p. 43.)
1887, Cope, Bull. U. S. Nat. Mus., No. 32, p. 65.)
(1889, Stejneger, Proc. U. S. Nat. Mus., pp. 94, 97, 98.)
1891, Stejneger, Proc. U. S. Nat. Mus., pp. 512–515.

The type of this species was collected in "northern Lower California," by Wm. M. Gabb.

CHILOMENISCUS STRAMINEUS Cope.

Chilomeniscus stramineus.

1860, Cope, Proc. Ac. Nat. Sci. Phila., p. 339.

The ground color of the upper surfaces of the adult specimens varies from brownish drab to bright yellowish cinnamon. It is cream buff in a younger individual. The dark dots near the tips of the scales are present in all the specimens, but do not appear upon the first row of scales. They are rarely present upon the scales of the second row, but constantly upon those of the third. The first, second, and half of the third rows of scales are yellowish white or straw color, as are also the gastrosteges.

This beautiful little snake was first described from specimens collected at Cape San Lucas by Mr. Xantus. It was afterwards found by Mr. Belding, at La Paz.

List of specimens of Chilomeniscus stramineus.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
453	San José del Cabo, L. C.	March, 1892	Gustav Eisen.
814	"	Sept., 1893	"
815	"	"	"
816	"	"	"
877	"	May, 1893	"
990	Miraflores, L. C.	Oct., 1893	"
1170	"	Sept., 1894	Eisen and Vaslit.
2199	"	Oct., 1893	Gustav Eisen.

CHILOMENISCUS FASCIATUS (Cope).

Chilomeniscus cinctus.

1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 86.

(1887, Belding, West. Am. Scientist, iii, 24, p. 98.)

Chilomeniscus stramineus fasciatus.

1892, Cope, Proc. U. S. Nat. Mus., 1891, p. 595.

Chilomeniscus stramineus.

[1894, Boulenger, Cat. Snakes Brit. Mus., ii, p. 273 (part).]

This species is known only from two specimens collected by Mr. Belding at La Paz, in 1882.

As no intergradation with other forms has been shown, Professor Cope is not followed in the use of a trinomial.

TANTILLA PLANICEPS (Blainv.)

Coluber planiceps.

"1835, Blainville, Nouv. Ann. Mus., iv, p. 294, pl. 27, figs. 3–3b.

(1853, Baird and Girard, Cat. N. A. Reptiles, i, Serpents, p. 154.)

Homalocranion planiceps.

1854, Duméril et Bibron, Erpétologie Générale, vii, p. 857.

"1863, Jan, Elenco sist. degli Ofidi, p. 40."

"1866, Jan and Sordelli, Iconogr. génér. des Ophid., 15e livr., pl. ii, 2."

1883, Bocourt, Miss. Sci. au Mex., p. 581, pl. xxxvi, fig. 7-7d.

Tantilla planiceps.

(1875, Cope, Bull. U. S. Nat. Mus., No. 1, p. 35.)

"1875, Cope, Journ. Ac. Nat. Sci. Phila., p. 143."

(1883, Yarrow, Bull. U. S. Nat. Mus., No. 24. pp. 13, 190.)

(1883, S. Garman, Mem. Mus. Compr. Zoöl. Cambr., viii, 3, pp. 89, 163.)

(1884, S. Garman, Bull. Essex Inst., xvi, 1, p. 31.)

(1887, Cope, Bull. U. S. Nat. Mus., No. 32, p. 84.)

(1892, Cope, Proc. U. S. Nat. Mus., 1891, p. 598.)

It is interesting to be able to assign a definite habitat to this long lost species, which has been known from a single specimen collected by Botta, in "California," early in the second quarter of our century.

is separated from the labials by two longitudinally placed temporals. There are seven superior labials (the third and fourth entering the orbit) and six infralabials (the first pair in contact on the middle line). The anal plate is divided.

There is little variation in color. A specimen from San José del Cabo may be described thus: The top of the head, the temporal regions, and the first five transverse rows of scales on the neck are brown, changing gradually from hair brown, on the snout, to deep clove brown posteriorly. On the sixth and seventh rows of scales of the neck is a whitish collar about as wide as the length of one scale. The rest of the upper surface is bright broccoli brown, slightly vinaceous on the tail. The posterior three-fourths of the ventral surface are tinged with coral red, brightest immediately in front of the anus. The anterior fourth of the ventral surface is pale grayish clay color, but may have been red in life, as this color has entirely disappeared from all parts of the belly in other specimens.

The specimens mentioned in the following table are all from San José del Cabo except the first, which was secured in the Sierra de la Laguna.

Postoculars.	Scale rows.	Urosteges.	Gastrosteges	Length of tail in mm.	Total length in mm.
2-2	15	57	139	57	224
2-2	15	57	138	34	155
2-2	15	49	139	23	123
2-2	15	55	139	67	260
2-2	15	58	140	64	251
1-1	15	55	139	63	251

No. 446 has the frontal plate partially united with the prefrontals. The first pair of infralabials are separated below in No. 2208.

List of specimens of Tantilla planiceps.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
440 to 445	San José del Cabo, L. C.	1892	W. E. Bryant.
446	"		Gustav Eisen.
537	Sierra Laguna, L. C.	Mar. 27, 1892	"
996	San José del Cabo, L. C.	May, 1893	"
2208	Lower California.		

RHINOCHILUS LECONTEI B. & G.

Rhinochilus lecontei.
(1853, Baird and Girard, Cat. N. A. Reptiles, i, Serpents, p. 120.)
1880, Lockington, Am. Nat., p. 295.

Mr. Lockington has recorded this species as having been collected by Mr. W. J. Fisher, " at or to the south of Magdalena Bay," Lower California.

The type came from San Diego, Cal.

viduals from Lower California differ from those collected in California, in having the scales of the white rings marked basally with black or dark brown. This black edging seems to appear first upon those scales which are nearest the median dorsal line, and to extend to the lateral ones and over more and more of the surface of each scale, as the animal increases in size.

The type was taken by John Xantus near Cape San Lucas. Mr. Belding found the species at La Paz.

List of specimens of Lampropeltis conjuncta.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
618	San José del Cabo, L. C.		W. E. Bryant.
801 to 809	"	Sept., 1893	Gustav Eisen.
865	"	Oct., 1893	"
1560	"	Sept., 1894	Eisen and Vaslit.
1561	"	"	"
1562	"	"	"

LAMPROPELTIS NITIDA new species. Plate xiv.

Diagnosis.—Allied to *L. californiæ*, but with the gastrosteges, urosteges, and upper surfaces of head and snout, entirely brownish black.

Type.—Cal. Acad. Sci. No. 800, San José del Cabo, Lower California, Gustav Eisen, September, 1893.

Description of the Type.—The head is slightly distinct, considerably depressed, its plates normal; one loreal; one pre- and two postoculars; scales in twenty-three rows, smooth, with two apical pits; postgeneials very small; anal entire; seven superior labials, the third and fourth entering the orbit; two hundred and twenty-seven gastrosteges; fifty-six pairs of urosteges.

The back and sides are blackish brown; the former, with a rather indistinct longitudinal line composed of cinnamon colored spots upon the centers of the scales of the median series, and upon the inner edges of those forming the first row on each side of this series; the latter, with a few scales of the first and second rows dotted, centrally, with cinnamon or yellowish white. A band of cinnamon crosses the nape. The gulars, geneials, and inferior labials, are blackish brown with paler centers. The plates on the top and sides of the head are brownish black, with faintly indicated dots of raw umber upon the loreal, pre- and postocular plates, and near the posterior edges of the supraoculars and parietals. There are six cinnamon colored blotches on the upper surface of the tail. The gastrosteges and urosteges are entirely brownish black, with the exception of the first ten gastrosteges, which show faint cinnamon colored dots.

Total length 965 mm. Tail 125 mm.

A small specimen (290 mm.) has, on the sides, rather numerous cinnamon colored blotches or enlargements of a similarly colored longitudinal line. This line is of about the width of one row of scales, and occupies the tips of

Hypsiglena ochrorhyncha.

(1875, Cope, Bull. U. S. Nat. Mus., No. 1, pp. 38, 92.)
(1880, Lockington, Am. Nat., xiv, p. 295.)
1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, pp. 15, 97.
(1883, Garman, Mem. Mus. Compr. Zoöl. Cambr., viii, 3, pp. 80, 161.)
(1884, Garman, Bull. Essex Inst., xvi, 1, p. 30.)
(1887, Cope, Bull. U. S. Nat. Mus., No. 32, p. 78.)
(1887, Belding. West Am. Scientist, iii, 24, p. 98.)
(1892, Cope, Proc. U. S. Nat. Mus., 1891, p. 617.)

The present specimens all agree in having "pseudo-preoculars," flat heads, and dark postocular stripes covering less than half of the sixth supralabial plates—the characters said to distinguish *H. ochrorhyncha* from *H. texana* Stejneger, and *H. chlorophæa* Cope.

The total length of the largest specimen is 525 mm.

This species was originally described from specimens collected by Mr. Xantus at Cape San Lucas. Mr. Belding obtained others at La Paz, in 1882. It is not confined to Lower California.

List of specimens of Hypsiglena ochrorhyncha.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
757	San José del Cabo, L. C.	Oct. 7, 1890	W. E. Bryant.
811	"	Sept., 1893	Gustav Eisen.
868	"	Oct., 1893	"
1407	Sierra San Lazaro, L. C.	Sept., 1894	Eisen and Vaslit.
1408	"	"	"
1548	San José del Cabo, L. C.	"	"
2202	San Francisquito, Sierra Laguna, L. C.	Mar. 28, 1892	Gustav Eisen.

PHYLLORHYNCHUS DECURTATUS (Cope).

Phimothyra decurtata.

1868, Cope, Proc. Ac. Nat. Sci. Phila., p. 310.
(1875, Cope, Bull. U. S. Nat. Mus., No. 1, pp. 38, 92.)
1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, pp. 99, 191.
(1887, Belding, West Am. Scientist, iii, 24, p. 98.)

Salvadora decurtata.
(1883, Garman, Mem. Mus. Compr. Zoöl. Camb., viii, 3, pp. 39, 145.)
(1884, Garman, Bull. Essex Inst., xvi, p. 25.)
(1887, Cope, Bull. U. S. Nat. Mus., No. 32, p. 72.)
(1888, Bocourt, Miss. Sci. au Mex., Reptiles, 11e livr., p. 663.)
Phyllorhynchus decurtatus.
1890, Stejneger, Proc. U. S. Nat. Mus., p. 154.
(1892, Cope, Proc. U. S. Nat. Mus., 1891, p. 618.)
Lytorhynchus decurtatus.
(1893, Boulenger, Cat. Snakes Brit. Mus., i, p. 417.)

This peculiar snake has not been found by any of the California Academy's expeditions to Lower California.

The type was collected, by Mr. Wm. M. Gabb, in the "upper part of Lower California." Mr. L. Belding obtained a second specimen at La Paz.

SALVADORA GRAHAMIÆ B. and G.

Salvadora grahamiæ.
(1853, Baird and Girard, Cat. N. A. Reptiles, 1, Serpents, p. 104.)
(1887, Cope, Bull. U. S. Nat. Mus., No. 32, p. 72.)
(1892, Cope, Proc. U. S. Nat. Mus., 1891, p. 619.)
Phimothyra grahamiæ.
1861, Cope, Proc. Ac. Nat. Sci. Phila., p. 300.
(1875, Yarrow, U. S. G. G. Surv. W. 100th Mer., v, p. 538.)
(1875, Coues, U. S. G. G. Surv. W. 100th Mer., v, p. 620.)

Another individual has this plate present on one side only, thus agreeing with the specimen from St. Thomas, Nevada, recorded by Dr. Stejneger (l. c., p. 206), who also mentions and figures specimens in which a second subocular is present. In view of these facts, it appears that this character is not constant enough to warrant the retention of the name *hexalepis*.

The largest individual measures 940 mm. in total length.

This species was first described from a specimen collected by Col. J. D. Graham, in "Sonora, Mex." Subsequently, Mr. Xantus found it at Cape San Lucas, and Mr. Belding, at La Paz.

List of specimens of Salvadora grahamiæ.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
652	Comondu, L. C.	Mar. 3, 1889	W. E. Bryant.
760	Agua Caliente, L. C.	Oct., 1890.	"
761	"	"	"
762	San José del Cabo, L. C.	Oct. 7, 1890	"
812	"	Sept., 1893	Gustav Eisen.
813	"	"	"
876	"	Aug., 1893	"
1406	Sierra San Lazaro, L. C.	Sept., 1894	Eisen and Vaslit.
1546	San José del Cabo, L. C.	"	"

BASCANION FLAGELLUM FRENATUM Stejn.

Bascanium flagelliforme testaceum.

1875, Cope, Bull. U. S. Nat. Mus., No. 1, p. 40.
1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 112.
(1887, Belding, West Am. Scientist, iii, No. 24, p. 89.)
(1887, Cope, Bull. U. S. Nat. Mus., No. 32, p. 71.)

Bascanium flagelliforme.

1891, Cope, Proc. U. S. Nat. Mus., p. 626 (part).

Bascanion flagellum frenatum.

1893, Stejneger, N. A. Fauna, No. 7, p. 208.

The specimens enumerated below have been compared with a number from Southern California,* and found not appreciably different, except that the Lower Californian snakes seem to have the black markings at the bases of the dorsal and lateral scales often larger and more numerous. Even this character is, however, rather inconstant, and there seems, therefore, to be no reason for making the separation tentatively suggested by Dr. Stejneger.†

The type came from Mountain Spring, Colorado Desert, San Diego Co., California. Mr. Xantus found the species at Cape San Lucas. The three specimens collected by Mr. Belding at La Paz, and recorded by Dr. Yarrow under the name *B. flagelliforme testaceum*, doubtless belong here.

List of specimens of Bascanion flagellum frenatum.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
483	San José del Cabo, L. C.	April 4, 1892	Gustav Eisen.
484	"	April, 1892	W. E. Bryant.
535	"	Sept. 30, 1890	"
602	"	Oct. 6, 1890	"

BASCANION AURIGULUM Cope.

Drymobius aurigulus.

1861, Cope, Proc. Ac. Nat. Sci. Phila., p. 301.

Bascanium aurigulum.

(1875, Cope, Bull. U. S. Nat. Mus., No. 1, pp. 40, 92.)

(1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, pp. 113, 191.)

(1887, Cope, Bull. U. S. Nat. Mus., No. 32, p. 71.)

(1887, Belding, West. Am. Scientist, iii, 24, p. 99.)

Coluber flagelliformis var. *aurigulus.*

(1883, S. Garman, Mem. Mus. Compr. Zoöl. Cambr., viii, 3, pp. 44, 148.)

(1884, S. Garman, Bull. Essex Inst., xvi, 1, p. 26.)

Bascanium laterale auriqulum.

(1892, Cope, Proc. U. S., Nat. Mus., 1891, p. 629.)

The apparent rarity of this species may be due to ignorance of its habits. The various expeditions sent by the Academy to Lower California have secured one specimen. It agrees perfectly with Cope's original description of the only other known representative of the species, secured by Mr. Xantus at Cape San Lucas.

Although this species is undoubtedly closely related to *B. laterale*, no intergradation has been shown, and there seems to be, therefore, no reason for using a trinomial appellation in this connection.

The present specimen (Cal. Acad. Sci. No. 870) is 1.045 m. in length, of which the tail forms 348 mm. It was collected by Gustav Eisen, at San José del Cabo, in November, 1893.

PITUOPHIS CATENIFER DESERTICOLA Stejn.

Pityophis sayi bellona.

1877, Streets, Bull. U. S. Nat. Mus., No. 7, p. 40.

(1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 106.)

Pituophis catenifer deserticola.

1893, Stejneger, N. A. Fauna, No. 7, p. 206.

Dr. Streets has recorded a specimen of this snake from San Martin Island, off the Pacific coast of Lower California. It is a locality where *P. catenifer* might rather be expected to occur.

PITUOPHIS VERTEBRALIS (Blainv.)

Coluber vertebralis.
1835, Blainville, Nouv. Ann. Mus., iv, p. 293, pl. 27, fig. 2-2b.
(1853, Baird and Girard, Cat. N. A. Reptiles, 1, Serpents, p. 152.)

Pituophis vertebralis.
1854, Duméril et Bibron, Erpétologie Générale, vii, p. 238.
1888, Bocourt, Miss. Sci. au Mex., Reptiles, 11e livr., p. 672, pl. xlvii, figs. 1-1d.

Pityophis hæmatois.
1860, Cope, Proc. Ac. Nat. Sci. Phila., p. 342.

Pityophis melanoleucus vertebralis.
"1863, Jan, Elenco, sist. degli Ofidi, p. 59."
" , Jan, Iconogr. génér. Oph., 22e livr., pl. 1, fig. 3."

Pityophis vertebralis.
(1875, Cope, Bull. U. S. Nat. Mus., No. 1, pp. 39, 92.)
1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 107.
(1884, Garman, Bull. Essex Inst. xvi, p. 27.)
(1887, Cope, Bull. U. S. Nat. Mus., No. 32, p. 72.)
(1887, Belding, West Am. Scientist, iii, 24, p. 98.)
(1892, Cope, Proc. U. S. Nat. Mus., 1891, p. 642.)

Pityophis catenifer.
(1883, Garman, Mem. Mus. Compr. Zoöl. Cambr., viii, 3, pp. 52, 150 [part].)

Professor Cope's description (Proc. Ac. Phila., 1860, p. 342) gives a good idea of this species. Many of the scales of the red dorsal blotches have blackish centers, *Pituophis vertebralis* was originally described from a specimen which Botta collected in "California." Mr. Xantus found it at Cape San Lucas, and Mr. Belding at La Paz.

List of specimens of Pituophis vertebralis.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
221	San José del Cabo, L. C.	Mar., 1892	W. E. Bryant.
485	"	"	"
752	"	Sept. 20, 1890	"
790	"	Sept., 1893	Gustav Eisen.
791	"	"	"
792	"	"	"
867	"	Oct., 1893	"
1186	Miraflores, L. C.	Sept., 1894	Eisen and Vaslit.
1563 to 1566	San José del Cabo, L. C.	"	"
1569	"	"	"
1570	"	"	"

THAMNOPHIS CYRTOPSIS COLLARIS (Jan).

Thamnophis cyrtopsis var. *cyclides.*
1861, Cope, Proc. Ac. Nat. Sci. Phila., p. 299.
Eutænia cyrtopsis.
(1875, Cope, Bull. U. S. Nat. Mus., No. 1, p. 41.)
(1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 121.)
(1887, Cope, Bull. U. S. Nat. Mus., No. 32, p. 73.)
(1887, Belding, West. Am. Scientist, iii, 24, p. 99.)
Eutænia cyrtopsis collaris.
(1892, Cope, Proc. U. S. Nat. Mus., 1891, p. 657.)
Tropidonotus ordinatus var. *eques.*
(1893, Boulenger, Cat. Snakes Brit. Mus., i, p. 209.)

Since Mr. Xantus secured a single garter snake at Cape San Lucas, no representative of this genus has been recorded from Lower California. It seems hardly probable that the Lower Californian form is identical with that of the Mexican mainland.

NATRIX VALIDA (Kenn.)

Regina valida.
1860, Kennicott, Proc. Ac. Nat. Sci. Phila., p. 334.
(1887, Cope, Bull. U. S. Nat. Mus., No. 32, p. 74.)
Tropidonotus tephropleura.
1860, Cope, Proc. Ac. Nat. Sci. Phila., p. 341.
Tropidonotus validus validus.
(1875, Cope, Bull. U. S. Nat. Mus., No. 1, p. 42.)
(1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 132.)
(1887, Belding, West Am. Scientist, iii, 24, p. 99.)
Tropidonotus validus tephropleura.
1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 133.
(1887, Belding, West Am. Scientist, iii, 24, p. 98.)
Tropidonotus leberis validus.
[1883, Garman, Mem. Mus. Compr. Zoöl. Cambr., viii, 3, pp. 28, 143 (part).]
Natrix valida valida.
1892, Cope, Proc. U. S. Nat. Mus., 1891, p. 670.
Tropidonotus validus.
1893, Boulenger, Cat. Snakes, Brit. Mus., i, p. 237 (part).
(1894, Günther, Biologia C.-Am., p. 134.)

The following table, based upon fifteen specimens from San José del Cabo, will serve to show the variation in the scale characters of this species.

Temporals.

Many specimens contained fish which Dr. Chas. H. Gilbert has identified with *Mugil brasiliensis*.

Natrix valida was first described by Robert Kennicott, in 1860, from a specimen collected in Durango, Mexico, by Lieut. Couch. Professor Cope described others contemporaneously from Cape San Lucas, under the name *Tropidonotus tephropleura*. Mr. Belding found the species at La Paz. It appears to be the most abundant snake of the country immediately surrounding San José del Cabo.

List of specimens of Natrix valida.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
454 to 462	San José del Cabo, L. C.	Mar., 1892	Gustav Eisen.
486	"	"	W. E. Bryant.
538	"	Mar. 16, 1892	"
603	"	Oct. 6, 1890	"
540	"	Mar., 1892	Gustav Eisen.
614	"	Sept. 6, 1890	W. E. Bryant.
615	"	Sept. 28, 1890	"
616	"	"	"
617	"	"	"
755	"	Oct., 1890	"
756	"	"	"
783 to 788	"	Sept., 1893	Gustav Eisen.
873	"	Nov., 1893	"
1580 to 1617	"	Sept., 1894	Eisen and Vaslit.

NATRIX CELÆNO (Cope).

Tropidonotus celæno.
1860, Cope, Proc. Ac. Nat. Sci. Phila., p. 341.
1861. Cope, Proc. Ac. Nat. Sci. Phila., p. 298.
Tropidonotus validus celæno.
(1875, Cope, Bull. U. S. Nat. Mus., No. 1, pp. 42, 93.)
(1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 133.)
(1887, Belding, West Am. Scientist, iii, 24, p. 99.)
Regina valida celæno.
(1887, Cope, Bull. U. S. Nat. Mus., No. 32, p. 74.)
Tropidonotus leberis validus.
[1883, Garman, Mem. Mus. Compr. Zoöl. Cambr., viii, 3, p. 143, (part).]
Natrix valida celæno.
1892, Cope, Proc. U. S. Nat. Mus., 1891, p. 670.
Tropidonotus validus.
[1893, Boulenger, Cat. Snakes Brit. Mus., i, p. 237 (part).]

There seem to be no structural differences between this and the preceding species. In fact, it is not improbable that *N. celæno* will ultimately be found to have been established upon melanistic individuals of *N. valida*. Until this has been shown to be the case, however, they must be regarded as distinct species, for they live in the same localities without any apparent tendency towards intergradation, so far as the specimens before me reveal.

List of specimens of Natrix celæno.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
612	San José del Cabo, L. C.	Sept. 18, 1890	W. E. Bryant.
789	"	Sept., 1893	Gustav Eisen.
1185	Miraflores, L. C.	Sept., 1894	Eisen and Vaslit.
1359	"	"	"
1578	San José del Cabo, L. C.	"	"
1579	"	"	"

TRIMORPHODON LYROPHANES Cope.

Lycodon lyrophanes.
1860, Cope, Proc. Ac. Nat. Sci. Phila., p. 343.
Trimorphodon lyrophanes.
1861, Cope, Proc, Ac. Nat. Sci. Phila., p. 297.
(1875, Cope, Bull. U. S. Nat. Mus., No. 1, p. 38.)
1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, pp. 15, 98.
1886, Cope, Proc. Am. Philos. Soc., p. 286.
(1887, Cope, Bull. U. S. Nat. Mus., p. 68.)
(1892, Cope, Proc. U. S. Nat. Mus., 1891, p. 679.)

The specimens in the collection of the California Academy of Sciences agree perfectly with Prof. Cope's original description, except in the number of scale rows and loreal plates. One of the seven has twenty-one rows of scales, two have twenty-two, and the remaining four have twenty-three rows. Each of four of these specimens has a small plate in the notch between the second and third supralabials, below the posterior loreal, and in front of the two inferior preoculars. The largest individual (No. 482) is 990 mm. in total length, 155 mm. representing the tail. It is a female, and contains eggs measuring about 9x21 mm.

The types of this species were secured by Mr. Xantus at Cape San Lucas. Mr. Belding found other specimens at La Paz, in 1882.

List of specimens of Trimorphodon lyrophanes.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
482	San José del Cabo, L. C.	Mar. 16, 1892	W. E. Bryant.
810	"	Sept., 1893	Gustav Eisen.
878	"	May, 1893	"
1405	Sierra San Lazaro, L. C.	Sept., 1894	Eisen and Vaslit.
1549	San José del Cabo, L. C.	"	"
2209	Lower California.		
2210	"		

CROTALIS ATROX B. and G.

Crotalus atrox.

(1853, Baird and Girard, Cat. N. A. Reptiles, i, Serpents, p. 5.)

Caudisona atrox sonoraensis.

1861, Cope, Proc. Ac. Nat. Sci. Phila., p. 292.

Crotalus adamanteus atrox.

(1875, Cope, Bull. U. S. Nat. Mus., No. 1, p. 33.)
1877, Streets, Bull. U. S. Nat. Mus., No. 7, p. 40.
1883, Yarrow, Bull. U. S. Nat. Mus., p. No. 24, p. 75.
(1889, Cope, Proc. U. S. Nat. Mus., p. 147.)

List of specimens of Crotalus atrox.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
653	Lower California.	1889	
775 to 782	San José del Cabo, L. C.	Sept., 1893	Gustav Eisen.
860	"	Oct., 1893	"
861	"	"	"
973	Sierra El Taste, L. C.	Sept., 1893	"
1542 to 1545	San José del Cabo, L. C.	Sept., 1894	Eisen and Vaslit.
1550 to 1559	"	"	"

CROTALUS LUCIFER B. & G.

Crotalus lucifer.
(1852, Baird and Girard, Proc. Ac. Nat. Sci. Phila., p. 177.)
1880, Lockington, Am. Nat., p. 295.

Mr. Lockington has recorded this species from the northern part of the peninsula.

CROTALUS EXSUL Garman.

Crotalus exsul.
1883, S. Garman, Mem. Mus. Compr. Zoöl. Cambr., viii, 3, pp. 114, 174.
(1884, S. Garman, Bull. Essex Inst., xvi, 1, p. 35.)

Under this name, Garman has described a small rattlesnake from Cedros (= Cerros) Island, Lower California. It seems to be very closely related to *C. atrox.*

CROTALUS ENYO Cope.

Caudisona enyo.
1861, Cope, Proc. Ac. Nat. Sci. Phila., p. 293.
(1866, Cope, Proc. Ac. Nat. Sci. Phila., p. 309.)

Crotalus enyo.
(1875, Yarrow from Cope, U. S. G. G. Surv. W. 100th Mer., v, p. 534.)
(1875, Cope, Bull. U. S. Nat. Mus., No. 1, pp. 33, 92.)
(1883, Yarrow, Bull, U. S. Nat. Mus., No. 24, p. 74.)
(1887, Cope, Bull. U. S. Nat. Mus., No. 32, p. 90.)
(1887, Belding, West Am. Scientist, iii, 24, p. 98.)
(1892, Cope, Proc. U. S. Nat. Mus., 1891, p. 693.)
Crotalus oregonus enyo.
(1883, S. Garman, Mem. Mus. Compr. Zoöl. Cambr., viii, 3, p. 174.)
(1884, S. Garman, Bull. Essex Inst., xvi, 1, p. 35.)

This rare rattlesnake is apparently of small dimensions, the largest individual measuring only 810 mm. to the base of the rattle.

The scale rows vary in number from twenty-five to twenty-six; the gastrosteges, from one hundred and sixty-one to one hundred and seventy-two; the urosteges, from twenty to twenty-eight. The first and several (1 to 5) of the posterior urosteges are divided. The scales of the first row only, and not all of these, are smooth. There is considerable variation in the number, shape, and relative size of the head scales of different specimens.

Mr. Xantus collected the type at Cape St. Lucas. Mr. Belding found a single specimen at La Paz.

CROTALUS MITCHELLII Cope.

Caudisona mitchellii.
- 1861, Cope, Proc. Ac. Nat. Sci. Phila., p. 293.
- (1866, Cope, Proc. Ac. Nat. Sci. Phila., p. 310.)

Crotalus mitchellii.
- (1875, Yarrow from Cope, U. S. G. G. Surv. W. 100th Mer., v, p. 535.)
- (1875, Cope, Bull. U. S. Nat. Mus., No. 1, pp. 33, 92.)
- 1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, pp. 73, 189.
- (1887, Cope, Bull. U. S. Nat. Mus., No. 32, p. 90.)
- (1887, Belding, West Am. Scientist, iii, 24, p. 98.)
- (1892, Cope, Proc. U. S. Nat. Mus., 1891, p. 694.)
- 1894, Van Denburgh, Proc. Cal. Ac. Sci., Ser. 2, iv, p. 450.

Crotalus pyrrhus.
- 1877, Streets, Bull. U. S. Nat. Mus., No. 7, p. 39.
- (1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 73.)
- (1890, Townsend, Proc. U. S. Nat. Mus., xiii, p. 144.)
- (1891, Stejneger, West Am. Scientist, vii, April, p. 165.)
- (1892, Cope, Proc. U. S. Nat. Mus , 1891, p. 694.)

Crotalus oregonus mitchellii.
- (1883, S. Garman, Mem. Mus. Compr. Zoöl. Cambr., viii, 3, p. 173.)
- (1884, S. Garman, Bull. Essex Inst., xvi, 1, p. 35.)

Since the identity of *C. pyrrhus* with *C. mitchellii* was shown in these Proceedings (1894, p. 450), the Academy has obtained twelve additional specimens of this snake. These show as much individual variation as regards the scales on the head as the ten specimens already recorded. One is deep pinkish buff in general coloration, while the others are of the more usual grayish tint. Among them are three very young specimens which Mr. Vaslit informs me were taken from a large female secured at San José del Cabo, thus showing that this species is ovoviviparous. The largest specimen is somewhat longer than any previously recorded from Lower California, being forty-one inches in length.

This species, which seems to be most closely allied to *Crotalus cerastes* of our southwestern deserts, was originally described from a specimen obtained by Mr. John

Xantus at Cape San Lucas. Mr. L. Belding secured another at La Paz, and Dr. Streets and Mr. Townsend each collected one on Angel de la Guardia Island. It has been found in California and Arizona,

List of specimens of Crotalus mitchellii.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
623	Santa Margarita Island, L. C.	Feb., 1889	W. E. Bryant.
654	Las Huavitas, L. C.	1889	"
764	Sierra El Taste, L. C.	Sept., 1893	Gustav Eisen.
765	San José del Cabo, L. C.	Oct., 1893	"
766	Lower California.		W. E. Bryant.
767 to 770	San José del Cabo, L. C.	Sept., 1893	Gustav Eisen.
771	"	Oct., 1889	"
1187 to 1190	Miraflores, L. C.	Sept., 1894	Eisen and Vaslit.
1404	Sierra San Lazaro, L. C.	"	"
1535 to 1541	San José del Cabo, L. C.	"	"

EXPLANATION OF PLATES.

PLATE IV.

Chrysemys nebulosa, new species.

Type. (No. 2244, Lower California, abreast of San José Island.)
(One and seven-tenths times natural size.)

PLATE V.

Chrysemys nebulosa, new species.

Type. (No. 2244, Lower California, abreast of San José Island.)
(One and seven-tenths times natural size.)

PLATE VI.

Chrysemys nebulosa, new species.

Type. (No. 2244, Lower California, abreast of San José Island.)
a. Head from side. (Twice natural size.)
b. Head from above. (Twice natural size.)
c. Fore limb from above. (Two and one-fourth times natural size.)
d. Hind limb from below. (Two and one-fourth times natural size.)
e. Tail from above. (Twice natural size.)

PLATE VII.

Uta repens, new species.

Type. (No. 633, Comondu, Lower California.)
General view. (About one and three-tenths times natural size.)

PLATE VIII.

Uta repens, new species.

Type. (No. 633, Comondu, Lower California.)
a. Head from side. (Two and three-fourths times natural size.)
b. Head from below. (Two and three-tenths times natural size.)
c. Fore limb. (One and eight-tenths times natural size.)
d. Scales of arm. (Three times natural size.)
e. Hind limb. (One and four-tenths times natural size.)

Uta microscutata Van D.

Type. (San Pedro Martir Mt., Lower California.)
f. Hind limb. (Three and four-tenths times natural size.)
g. Fore limb. (Three and four-tenths times natural size.)

PLATE IX.

Uta microscutata Van D.

Type. (San Pedro Martir Mt., Lower California.)
a. General view. (One and four-tenths times natural size.)
b. Head from side. (Four and nine-tenths times natural size.)
c. Head from above. (Four and nine-tenths times natural size.)
d. Head from below. (Four times natural size.)
e. Section of back. (Five and six-tenths times natural size.)

PLATE X.

Sceloporus licki, new species.
Type. (No. 1436, Sierra San Lazaro, Lower California.)
- *a*. General view. (About natural size.)
- *b*. Head from above. (Two and one-fourth times natural size.)
- *c*. Head from side. (Two and one-fourth times natural size.)
- *d*. Head from below. (Two and one-fourth times natural size.)
- *e*. Fore limb. (One and one-half times natural size.)
- *f*. Hind limb. (One and one-half times natural size.)
- *g*. Scale from back of thigh. (Four and seven-tenths times natural size.)
- *h*. Dorsal scale. (Four and seven-tenths times natural size.)

PLATE XI.

Xantusia gilberti, new species.
Type. (No. 401, San Francisquito, Sierra Laguna, Lower California.)
- *a*. General view. (Two and one-half times natural size.)
- *b*. Head from above. (Four times natural size.)
- *c*. Head from side. (Six times natural size.)
- *d*. Head from below. (Six and one-tenth times natural size.)
- *e*. Fore limb. (Six times natural size.)
- *f*. Hind limb. (Six times natural size.)

PLATE XII.

Verticaria sericea, new species.
Type. (No. 435, San José Island, Gulf of California.)
- *a*. General view. (About twice natural size.)
- *b*. Head from side. (Three times natural size.)
- *c*. Head from below. (Three times natural size.)
- *d*. Fore limb. (One and two-tenths times natural size.)

ON LAND AND FRESH WATER SHELLS OF LOWER CALIFORNIA. NO. 5.

BY J. G. COOPER.

Dr. Eisen, accompanied by Mr. F. H. Vaslit, made a short journey to the Sierra San Lazaro, twenty-five miles north of Cape St. Lucas, in the early summer of 1894, collecting for the California Academy of Sciences. At that point they obtained a few land shells, among which is one new species, besides additional specimens of others. They then crossed the gulf to Mazatlan, and spent some months in the region south of there, as far as Tepic, the collections made there, up to 3000 or 4000 feet, serving as material for another article following this.

BULIMULUS ARTEMISIA W. G. Binney.

One specimen is a fourth larger than any before obtained, but is bleached and shows no characters to distinguish it otherwise; 29 specimens brought.

BULIMULUS COOPERI Dall (*B. pilula* Crosse and Fisher, not of W. G. Binney).

One specimen, which I before referred to in article 2 (Proc. Cal. Acad., 2d series, vol. iii, p. 210), thus: "One specimen has faint traces of two bands on the body, but is otherwise bleached." After seeing the figures in C. & F.'s work, which are represented with two narrow bands on the body-whorl, I supposed that to be the normal condition of the fresh shell. But as Binney's type (which was from nearer the west coast) does not have bands, and also differs in form, while the bands do not quite disappear from bleaching, it seems that C. & F. were wrong in identifying their shells with *B. pilula* and a new name is needed. No more specimens are known to have been found lately, and, according to Dr. Dall, none of the specimens collected by the Academy's expeditions agree exactly with the types, although some show no more variation than we see in varieties of *B. xantusi.*

BULIMULUS DECIPIENS J. G. Cooper, n. sp.

I propose this name for a new form, of which three specimens were brought from San Lazaro Mt. They were living but apparently quite young, too immature to figure. The largest is nearly of the size and form of *B. pilula* as figured, but still more globular, being shorter and wider, with three whorls. It is more Heliciform, much resembling *H. californiensis* Young, and like that has a single vittiform band around periphery, which becomes hidden in the suture of two upper whorls. The band is, however, paler than the brownish epidermis (faded in alcohol?). To prove their affinity to the Bulimuli of the region, they show the vertical riblets on 1½ apical whorls, and a more sunken nucleus than in the Helix. No single-banded Helix is known for 200 miles north of the locality of this species.

BULIMULUS INSCENDENS W. G. Binney.

"I am now able to state that your *ramentosa* is a Bulimulus! The jaw is like that of Thysanophora exactly, and also like that of *Bul. artemisia*, while the teeth differ very little." He does not, however, notice the differences in the shell from that of the latter, and I therefore propose the above name, having before mentioned the resemblance in the nuclear whorls and epidermis to those of *B. artemisia* and suggested the affinity of the two forms on p. 138.*

Genus PSEUDOSUBULINA.

In describing *Melaniella eiseniana* in article 3, vol. iii, p. 339, of these Proceedings in 1893, I adopted the genus with a (?), remarking on the absence of jaw, but did not suspect it to have lingual teeth of the carnivorous type. These have been found in a specimen dissected by Dr. Dall, who refers this and *M. tastensis* to the above genus, and shows an apparent affinity in this respect to Oleacinidæ. Several genera resembling this species and *P. tastensis* in form of the shells have been referred to the same family, especially Megaspira and Balea. I would have put *P. eiseniana* in the latter genus if not misled by its external likeness to Stenogyra. But the fact of carnivorous dentition does not separate the families entirely in habits, as some species are known to eat vegetable food as a rule, not being able to obtain animal food suitable to their needs very often. They should rather be called omnivorous, and indeed there are probably few, if any, species even of the phyllovorous genera exclusively vegetivorous.

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*The subgenus name *Peronæus* cannot be used for either of these species, the name being preoccupied. The same is true of *Leptobyrsus*, it being used in the feminine form in entomology two years before C. & F. used it (Scudder).

ON WEST MEXICAN LAND AND FRESH WATER MOLLUSCA.

BY J. G. COOPER.

BULIMULUS EMEUS Say var. MEMBRANACEUS Martens.

Three specimens, only one full grown, seem to be of this species. They are very thin, translucent, the thickest pale yellowish, an inch long, whorls 5. They are from the vicinity of Tepic.

OLEACINA TURRIS and var. ALBERSI Pfeiffer *(Glandina turrita* Carpenter).

This was credited to California by Pfeiffer, but has not even been found on the peninsula. The eight fresh specimens brought from Mazatlan are intermediate between the two forms figured by Binney, and are from 1 to 1½ inch long, more like the typical *turris* than the var. *albersi*, which was the form from " California." Xantus found it at Colima in the Sierra Madre.

ORTHALICUS PRINCEPS Broderip.

But two of this genus were brought, which come nearest

PATULA HORNI Gabb.

The five specimens brought from Tepic do not differ from the Arizona type, or from the one found on the peninsula. They differ from any allied shell figured or described as from Eastern Mexico.

POLYGYRA HINDSI Pfeiffer.

Over fifty specimens were brought from Mazatlan, Tepic, etc., mostly fresh and full grown. All seem easily distinguishable from the next in size, being mostly about half as large, but there is a great difference in size among these small shells, varying in about the same proportions as the varieties of *H. monodon* called var. *leai* and var. *fraterna* as figured by Binney.

POLYGYRA VENTROSULA Pfeiffer.

Twenty-two specimens from the same region are about twice the size of the preceding. Both forms show specimens having a broad pale band on top of the body-whorl, while a narrow dark one runs along the suture and a wider one near the periphery, which in some becomes a reddish brown color covering the whole under surface of the shell. Generally these colors are faint or faded out, and they do not seem to have been described before.

SUBULINA OCTONA Chemnitz.

Twenty-two from San Blas seem to be of this species, which is said to range over most of tropical America and adjacent islands.

SUBULINA LIRIFERA? Morelet.

Seventy or more of a scalariform species from Tepic approach nearest to this species, which, however, was described as from Guatemala only. It is probably contained in the collections obtained from Tepic by the authors of Biol. Centrali–Americana, and I therefore defer its identification until the results of their study of this genus are printed.

SUCCINEA CALIFORNICA Crosse and Fischer.

This form was founded on specimens obtained near where Orcutt obtained those identified as *S. oregonensis* Lea, in Lower California, lat. 31°. Those found by others near Cape St. Lucas seemed to me to be nearer the *S. rusticana* Gould, perhaps a var. of last. Some of the latter had undulations more or less strongly marked, but they were not constant, and I did not consider them specific characters. It seems, however, that there is a *S. undulata* Say, from Mexico, probably from Acapulco. Those brought from Tepic are without undulations, and seem to me identical with *S. oregonensis*, while I cannot see any difference in the figures of *S. californica* C. & F. If the same, Say's name is prior to Lea's, but seems founded on an abnormal character, and not tenable.

TEBENNOPHORUS SALLEI C. & F.

Two specimens brought from Tepic are considered by Dr. Dall as probably this species.

VAGINULUS MORELETI C. & F.

One found at Tepic, and is said to be found also in Central America. Although somewhat contracted in alamined the animal taken from alcohol and found the jaw of Limnea.

PHYSA MEXICANA Philippi.

Two specimens two-thirds the size of Say's type of *P. heterostropha* figured by Binney in Fresh Water Shells, p. 84, seem to me to confirm identity of the species. They are less similar to Haldeman's *P. osculans* from Mexico.

PLANORBIS LIEBMANNI Dunker.

Over 70 specimens from Mazatlan do not differ in form or size from two Vera Cruz shells, whence the typical form was described. They are much smaller than Gould's *P. gracilentus* of the Colorado Desert, showing the same difference as in the figures given by Binney in Fresh Water Shells, p. 108. Binney says that the figure is enlarged, but Gould gives it as half an inch wide or larger than the figure, while the *P. liebmanni* is little over one-quarter inch. It comes nearer *P. havanensis*, which Pfeiffer says (l. c., p. 107) was found in Texas also, by Roemer. On p. 108, Roemer is quoted for only *P. liebmanni* from Texas, showing some confusion of the spe cies.

CALYCULINA PARTUMEIA Say, var. TRUNCATA Linsley.

One specimen from Tepic seems to agree better with this form than with any other, but is even flatter in proportion and smaller than usual, showing that those characters are not confined to the most northern shells, while the opposite extremes as found in *lenticula* are not exclusively western. It measures 0.27 inch long, 0.23 high, and 0.13 in diameter.

The only *calyculate* species described by Prime from Mexico is *Sphærium subtransversum* from Tabasco, and differs in very small size, more elongation and other characters. The size is given by Prime as length 0.30 inch, height 0.20, diameter 0.10.

ON HETEROMORPHIC ORGANS OF SEQUOIA SEMPERVIRENS ENDL.

BY ALICE EASTWOOD,

Curator of the Herbarium.

[With Plates xv-xviii.]

The following investigations were instigated by the discovery of a branch of redwood with foliage so unlike the ordinary form of *Sequoia sempervirens* that at first it seemed probable that a new variety of Sequoia had been discovered. The trees from which the branch must have fallen grow at the head of Sequoia Cañon in Marin County, on the southern side of Mt. Tamalpais, and differ from the trees in the lower part of the cañon in a more open straggling habit, a weather-beaten appearance, and a preponderance of branches densely covered with short, stout, closely appressed leaves.

A careful examination was made of one of the trees, and branches were obtained from both the upper and lower parts. Plate xvi, fig. 1, shows a piece from an upper branch with the peculiar foliage; fig. 2, a piece

In order to be sure that this was a universal and not a local characteristic, it was necessary to examine many trees in different localities. Besides the trees in Sequoia Cañon, I examined trees in Santa Cruz County, at Wright's and at Boulder Creek, and in Sonoma County at Duncan's Mills. At Boulder Creek the woodchoppers were at work destroying the forest, and I had an opportunity to examine many trees from the topmost to the lowest branches. Fine specimens were sent from Mendocino, Humboldt and Sonoma counties, in response to a request for branches from different trees and different parts of the same tree, also information concerning the size and location of the trees from which the specimens were obtained. Without any exception, the large trees—two, three or more feet in diameter—possessed heteromorphic foliage. Many small trees, a foot or so in diameter, were seen that had only the broad distichous leaves. There are always scale like leaves on young upper shoots; but on young trees they afterwards generally expand into the broad leaves. (Plate xv, fig. 2.)

From all these observations I conclude that all large trees of *Sequoia sempervirens* have the upper foliage quite different from the lower, with intermediate forms. This is not true of *Sequoia gigantea*, so far as my observation goes.

Among the forty or more fossil species of Sequoia described from the Northern Hemisphere it is interesting to note that the foliage of several species has been found to be heteromorphic. Of *Sequoia biformis*, Lesquereux, the author, says: "This species apparently bears two kinds of leaves even upon the same specimens, either long 2 cm. and very narrow linear, less than 1 mm. wide; or shorter and broader, decreasing gradually from the base to the point, linear-lanceolate nearly 1½ mm. wide and only 8 to 10 mm. long; the middle nerve is deeply marked upon both kinds of leaves." (Bull. No. 5, 2d series, Hayden's Geol. Survey of Terr., page 366.)

In Heer's "Flora Fossilis Arctica" illustrations are given of many fossil species. *Sequoia Langsdorfii* Heer, the species apparently most widely distributed in past ages, is similar to *S. sempervirens*, and the fossil specimens show dimorphic foliage. (Flora Fossilis Arctica, vol. ii, plate xliv, vol. iv, plates xiii–xiv.) The resemblance to *S. sempervirens* is quite evident. *S. Reichenbachi* Heer, vol. iii, plates xv–xxxvi, shows three forms of leaves on the same branch.

These go to prove that the genus Sequoia possesses a tendency towards heteromorphism, which the environment probably develops.

Along the coast *Sequoia sempervirens* does not grow above the altitude to which the moist sea air generally rises—the fog-line, as it is often called. This is more apparent near the southern limit of the species, which is between Pt. Gordo and San Simeon Bay. The luxuriance of the lower foliage may be due to the greater hu-

Range and are not found in the hot valley of the San Joaquin, but reappear in the Sierra Nevada mountains at an altitude of three or four thousand feet above the sea level, where they again come into almost the same conditions of humidity and temperature as at the coast.

The amount of light probably also exerts a great influence. The lower branches need more leaf surface because of the shade from the surrounding arboreal vegetation, while the upper boughs that rise above all the other trees have for themselves alone all the light and sunshine and so are not compelled to spread themselves out. Their energies are bent to the reproduction of the species, and with less nutrition economy is necessary.

As the parts of the flower are but transformed leaves, the same diversity might be expected. It is even greater. The carpellary scales of the pistillate aments take many forms. Plate xviii, figs. 2 and 3, show pistillate aments from different trees, figs. 4, 5, 6 carpellary scales. It will be noticed that in the same ament there is no uniformity, though the scales are longer and narrower in some than in others. The scales of the staminate aments range from the broad form shown in plate xviii, fig. 8, to one much narrower and more pointed. The number of pollen sacs is not invariable, three or four being the rule. The cones are round or oblong, and vary in size irrespective of the height of the tree. The seeds when ripe show many forms, figs. 9 and 11 being of one type, figs. 10 and 12 of another.

The proliferous cone shown in plate xvi, fig. 3, is interesting, as it illustrates the nature of the ament, a subject which has been discussed by many botanists. Such cones are not uncommon. Engelman says of a similar cone of *Sequoia gigantea:* "It seems to prove not only that the fruit scale in this species (and consequently in the whole tribe) is homologous with that of Abietineæ in so far as it consists of leaves of an axillary shoot, yet that these leaves are not a single pair, but, as A. Braun has long ago suggested in regard to Cupressineæ, that there is a number of leaves laterally co-ordinate and connate bearing a number of ovules on their back." (Bot. Gaz., vol. vii, pp. 104–105.)

Prof. Eichler regards the scales of the female ament in all coniferæ as representing nothing but simple leaves. (Bot. Gaz., vol. vii, p. 39. Review of Prof. Eichler's article by Prof. Geo. L. Goodale.) From the manner in which the scales are arranged on the axis of the cone, as well as the position of the resin ducts, as shown in plate xvii, sections 14–15, *S. sempervirens*, and 16–17 *S. gigantea*, this view seems the more reasonable.

Sequoia and Taxodium are the North American representatives of the tribe Taxodineæ, which is intermediate between Cupressineæ and Abietineæ. Several species of Juniperus and Cupressus of the Cupressineæ have heteromorphic foliage, also some species of Taxodium; but in none is the difference so marked as in *Sequoia sempervirens*, which approaches the Cupressineæ in its

EXPLANATION OF PLATES.

The figures in plates xv and xvi are the natural size. Plates xvii and xviii are magnified.

PLATE XV.

Fig. 1. Fruiting twig from a low branch of a small tree in Mill Valley, Marin County. The tree had grown from one of the suckers of a tree that had been felled many years ago. It shows the well-known broad distichous foliage.

Fig. 2. Flowering branch from the upper part of a small tree in the same locality. The young upper leaves are scale-like, but afterwards broaden out.

PLATE XVI.

Fig. 1. Fruiting branch from the upper part of a medium sized tree growing at the head of Sequoia Cañon. This is the characteristic upper foliage of the large trees—short, stout, scale-like leaves, similar to those of *S. gigantea*.

Fig. 2. Lower branch of the same tree with distichous foliage.

Fig. 3. Small twig with proliferous cone.

PLATE XVII.

Fig. 1. Broad leaf from the twig shown in plate xv, fig. 1. The canal down the center which is near the surface makes the central ridge seem depressed. Figs. 5 and 10 are cross-sections of similar leaves. The position and number of the resin ducts are seen to be variable in the different cross-sections of leaves of *S. sempervirens*, figs. 5, 10, 6, 7, 8, 9. In these sections the epidermis is represented by the parallel vertical dotted lines, the cross-sections of the resin duct by the openings, and the wood cells by the horizontal parallel lines.

Fig. 2. Young appressed leaf of branch shown in plate xv, fig. 2. The resin duct is nearer the surface at the upper and lower part of the leaf. The small irregularly placed dots represent the stomata. Fig. 6 cross-section of similar leaf.

Fig. 3. Leaf from the branch shown in plate xvi, fig. 2. Figs. 8 and 9 sections of same.

Fig. 4. Leaf from branch shown in Plate xvi, fig. 1. Fig. 7 cross-section of similar leaf. This is the form that resembles *S. gigantea*, as can be seen by comparing cross-sections. Figs. 11 and 12 sections of leaves of *S. gigantea*. Fig. 13 cross-section of the bract of a staminate ament.

Figs. 14 and 15. Sections of pistillate scales of *S. sempervirens*. It is not usual to find more than one resin duct in these scales. Figs. 16 and 17, sections of pistillate scales of *S. gigantea*.

PLATE XVIII.

Fig. 1. Staminate ament with bracts at base and the staminate scales attached to the axis.

Figs. 2 and 3. Pistillate aments to show variation in the scales.

Figs. 4 and 6. Pistillate scales, back view.

Fig. 5. Same, showing the naked ovules; the number is variable. The micropyle which receives the pollen can be seen at the top of the naked ovules. The long point on these scales becomes the inconspicuous bristle of the ripe cone.

Fig. 7. A bract of a pistillate ament.

Fig. 8. Scale of staminate ament, showing the stem that unites the scale to the axis, the pollen sacs, one of which is ripe and discharging pollen. The number is variable, but generally three.

Fig. 8c shows some pollen grains magnified.

Figs. 9, 10, 11, 12 are seeds and show two types of the variable seeds.

CALIFORNIA WATER BIRDS. No. I.—MONTEREY AND VICINITY FROM THE MIDDLE OF JUNE TO THE END OF AUGUST.

BY LEVERETT M. LOOMIS,

Curator of the Department of Ornithology.

[With Plate xix.]

A glance at a map of California will reveal that Monterey Bay is not a sheltered roadstead, but merely an abrupt inward bend in the coast-line. In the vicinity of the town of Monterey there is quite a heavy surf at all times, except in coves protected by little promontories that intercept and break the swell from the ocean. To the northward of the town, in the direction of Pt. Santa Cruz, the beach is sandy with high dunes immediately back. In the opposite direction, toward Pacific Grove, Pt. Pinos, and southward, the coast-line is rock-bound. Sunken rocks and miniature islets are numerous a few miles south of Pt. Pinos. These rocky islets are favorite resorts of seals, sea-lions, and water birds. The larger ones whose surfaces are above the reach of the surf are occupied as rookeries by sea birds during the breeding season.

While there is no rain during the summer months, cold fogs are frequent, and so dense are they sometimes, that they almost amount to drizzling rain. There were but few sunny days, owing to the "high fogs" and "low fogs," during the two months and a half of my stay in 1894. During a fortnight in June the sun was seen only on one day. These fogs hide the coast mountains, and consequently must have a marked influence upon the migratory birds that follow the coast-line in their journey southward. The locality is a very favorable one for observing the early southward movements, for there are no storms as upon the Atlantic seaboard. Disturbances far out on the ocean, however, produce quite heavy seas at times, necessitating some skill in the management of a row-boat when there is a strong breeze. The tides are not an obstacle. There is no wind during the forenoon until after nine o'clock, when a breeze usually springs up. The fishermen take advantage of this wind, and at midday the fleet stands in to the land. The curious palm sails of the Chinese and the lateen sails of the Italians give a picturesqueness to the scene, transporting the observer in imagination to far-distant countries.

The observations recorded on the following pages were made during the summers of 1892 and 1894; the first season covering the interval between June 20th and August 23d, and the second season between June 15th and August 28th. In June and July of 1892 my attention was partly directed to the land birds, but in 1894 my whole time was devoted to the water birds, and I was therefore able not only to verify but to extend the observations of the first season.

In 1892 I confined my efforts, so far as the water birds were concerned, chiefly to the bay, but in 1894 my work side Laboratory by two o'clock. A trip was made, June 25th, by land, to Carmel Bay, where I visited a Cormorant rookery on a rocky islet at the extremity of Pt. Carmel, or Pt. Lobos, as it is locally known.

EARLY SOUTHWARD MIGRATIONS.

As I have already published* some account of the migrations witnessed during the summer of 1892, my present remarks will be restricted chiefly to the summer of 1894.

The sea offers peculiarly favorable opportunities for studying migratory movements. On land much of migration readily escapes observation. Often only the birds that stop in a locality are noted. The greater perils and the natural and other obstructions necessitate a greater elevation of flight. Further, migration over the ocean continues during the daytime to an extent not usualy observed on land, resembling, perhaps, more the night migration of land birds. The vegetation of the land also affords means of concealment, and stragglers escape notice that would readily be seen on the water.

The occurrence of stragglers on isolated islets, as American birds on Heligoland (see Seebohm, "Ibis," 6th ser., vol. iv, pp. 1–32) or of the Catbird on the Farallones (Townsend, "Auk," vol. ii, p. 215), illustrate in another way the favorableness of the sea for the study of migration. It is not to be supposed that estrays visit such islets more frequently than they do the adjacent mainland. Over miles of water they find but a single resting place, so the chances of meeting them are many, but on the mainland in an area of equal extent, where any spot may be a resting place, the chances of seeing them are extremely few. Some years ago in upper South Carolina I tried the experiment, during the height of migration, of sending out each morning an assistant I had trained, to collect birds in a direction opposite from the one I would take myself. The results of our day's shooting were often very different—so different were they that I have since been fully convinced that a single observer, diligently spending each day in the field, can know but little of the rarer birds that happen to be in his neighborhood at the time of his observations, and how impossible it is for a single observer ever to exhaust a locality, even one of but a few square miles in extent.

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* "The Auk," vol. xi, pp. 27, 28, 29, 30, 95–98.

The incipient stages of southward migration of the species that breed in a locality are not always very apparent. Daily records intelligently kept afford a key, however, to these indefinite movements, for they gradually develop into those that are unmistakable. The immediate vicinity of Monterey is an advantageous situation for the study of such migration in sea birds, for there are no suitable places for rookeries, which causes the southward movements of individuals of breeding species of the region, from rookeries further up the coast, to be like the later in the season led to the conviction that there must be a rookery a short distance to the northward of Pt. Santa Cruz. Also on the 16th, many Dark-bodied Shearwaters were seen. They were flying steadily northward several miles out from land. In an hour not less than a thousand passed my boat. The movements of Shearwaters on the days that immediately followed indicated, for they were southward ones, that this was probably a local movement, though it may have been the ending of the northward migration of the species in this vicinity. In two males and two females that were taken, the organs of reproduction exhibited no signs of recent erotic development, which was also true of all captured afterwards. This circumstance raises the question whether the breeding habitat of this Shearwater is not in the Southern Hemisphere, as is believed to be the case in Wilson's Petrel.

June 18th, many California Murres were heading southward. Some were also on the water. Viewed in the light of the after movements, the stragglers on the water were apparently birds that had temporarily paused in the southward migration. Two females were taken. The ovaries in both showed that they had recently bred. In 1892, no females were secured before July 11th. The first migratory waves, however, were not comprehended that season, nor was there opportunity for thorough study of them. As many Dark-bodied Sheawaters were noted as on the 16th, but all were moving southward.

June 19th and 20th the movements were about the same as on the previous days. On the 21st there was an increase in California Murres, individuals and small parties in single file appeared from the northward, and passing quickly by disappeared to the southward, keeping the course of the coast-line. Solitary ones were quite numerous on the water. At least a thousand Dark-bodied

Shearwaters were seen. They were several miles off shore, and followed two parallel lines of flight about a quarter of a mile apart. They came from the northward, singly, in little companies, and in straggling flocks, and passed rapidly down the coast.

On the 23d there was considerable southward movement in these two species. On the 30th no Shearwaters were observed, and only several California Murres. The scarcity of this latter species rendered still more prominent its extensive movements during the preceding fortnight.

About a dozen Scoters, all seemingly female *deglandi*, were found near the Del Monte beach at Monterey on the 22d. Like the specimens procured two years ago, three females that were captured were in very worn plumage, and had apparently not bred, the ova in each being very indistinct. During the rest of my stay this species was seen at intervals. Its periods of absence were apparently similar to those intervening between migratory movements. The Surf Scoter was found in July and August, and was likewise somewhat irregular in its

July.—July 2d there was a great movement southward of Dark-bodied Shearwaters. The sea was very calm, although there was a heavy surf, and at midday the sky was clear. I was out on the water from eight in the morning until two in the afternoon, going as far down the coast as Pt. Cypress, keeping near the land on the way down and several miles off shore in returning. Only a few Shearwaters were seen before midday. These were heading rapidly down the coast. About noon many were seen at a distance off Pt. Cypress. They were also flying southward. On going out several miles from land it was found that there was almost a continuous stream of these birds coming from the northward and passing southward. They flew only a few feet above the water, flapping their wings a few times, then sailing for a few moments. The line of movement diverged somewhat to the seaward, as the birds sheared off to avoid the boat. After awhile, they began to pass on both sides of the boat, and it was discovered that there were two parallel lines of flight, as on the 21st of June. In returning up the coast to Monterey Bay, I kept in the path of movement, which was several miles distant from land, for about five miles. As it was clear, the birds could be seen a long way up and down the coast. It was fully determined that they followed the coast-line leading southward, conforming their course to the inward bend at Monterey Bay.

In rounding Pt. Pinos the Shearwaters approached much nearer to the shore than in the bay, a few stragglers even coming within several hundred yards of the surf. After passing the Point all shaped their course so as to regain their former distance from the land. The observations for the entire season in this and other species indicated that Pt. Pinos is a prominent landmark for water birds journeying southward.

At least three thousand of the Shearwaters were seen during the last two hours I was out on the ocean, and there was apparently no abatement in their movement before I returned to land. The two streams in which they moved were formed of straggling companies, varying from a few individuals to flocks of considerable size. Often there was a complete break, no birds being in sight for several minutes. None were seen on the water. Although a portion passed directly through a great gathering of Cormorants and Gulls that had been frightened from the water by the boat, they did not deviate from their course, apparently paying no attention to the great mass of birds flying in confusion about them. Neither did they decoy to wounded comrades, though Gulls were attracted to them, several alighting on the water close by the wounded birds.

With one of the large companies there was a white colored Fulmar. It was probably *Fulmarus glacialis rodgersii*, as that subspecies was secured a little later in the season.

Only two California Murres were seen. Both were

It has long been held that the individuals of a species found during the summer months south of the breeding range, but not breeding, are actual summer residents, having failed to migrate northward, or at least failed to complete the migration, owing to barrenness or some accidental cause. Such cause might possibly exist in temporary sickness or wounds, or the way may have been lost, particularly if the loiterers were young birds. This view is not incompatible with the fact of early southward migration. Such stragglers may occur, and when the tide of migration sets southward they may join the ranks of the early migrants of other species. The Fulmar alluded to above may be an example. It may not have reached the breeding habitat, and have come from a locality to the southward of it, joining the Shearwaters as they passed by or falling in with them on the way down the coast. The fluctuations occurring in the Scoters may have been occasioned by the early departure southward of June birds and the arrival of others a little later from further north—such local movement being in advance of the migration from the boreal breeding grounds. While fully recognizing physical debility and accident as factors in this question, too great stress must not be laid upon them, for ample allowance must be made for late northbound migrants and early southbound migrants, as the two migratory movements nearly or quite bridge over the interval of summer. Movements of Black Turnstones from the southern frontier of their breeding range, if they consumed a fortnight and were as early as those of the California Murres, would reach the vicinity of Monterey about the 1st of July. It should be added that the young of this Turnstone are able to take wing in July and leave the flats of the Lower Yukon for the sea-coast (Nelson, Rep. Nat. Hist. Coll. Alaska, p. 130).

On the 5th of July, in the vicinity of Monterey, there was no evident migratory movement. Only one Dark-bodied Shearwater and four California Murres were noted; the latter were on the water.

July 6th. Four Western Grebes were found near the surf within the bay. With the exception of one shot on the 2d, these were the first observed of the season.

July 7th. Several California Murres were seen. All were going southward. No Shearwaters were met with, although it was foggy—a favorable state of the weather for their occurrence near land. A male Harlequin Duck was shot as it was rounding Pt. Pinos. The testes were very large—those of a breeding bird. Another followed shortly after. Both came from the nothward.

July 9th. I remarked in my journal on this day that the Tufted Puffin is apparently to be reckoned among the early migrants. While there had been no pronounced migration, individuals had been passing southward daily for some time, with no corresponding return movements, as in Brandt's Cormorants, for example, which were continually coming into the bay to fish and returning to their

July 10th and 11th but little migration seemingly took place. The 11th nevertheless was a notable day, for the Northern Phalarope made its appearance, affording additional evidence that the movements witnessed all along were truly migratory movements. At first two were seen coming from the northward, about a mile off shore and a mile south of Pt. Pinos. Then two were found on the water a little further up the coast. When forced to take wing, they continued their flight southward. Nearly opposite Pt. Pinos, still a mile off shore, another appeared from the northward and alighted on the water. Within the bay, fully a mile out from land, a sixth was seen. It also came from up the coast. The only specimen taken was a female, and it had evidently bred the present year.

On the 12th, a visit to Seal Rocks disclosed that large numbers of Western and Heermann's Gulls were congregated there. That a considerable influx of these Gulls had taken place had been manifest for several days at the kelp along the south shore of the bay. A female Fulmar, apparently Rodgers's, was shot on the water near the extremity of Pt. Pinos at midday. It must have arrived while I was at Seal Rocks, for I passed over the spot during the morning. The sea was like glass, so it could hardly have been overlooked. Its ovaries were not those of a bird that had lately bred, and its plumage was greatly abraded. Two more Black Turnstones were secured at Seal Rocks. They were both males, and showed no enlargement of the sexual organs.

The 13th was another day of no very obvious migratory movements.

The second week of July marked a decided increase in the number of California Brown Pelicans seen. Most were young of the year. Each forenoon they came into Monterey Bay from the direction of Pt. Cypress. It was not ascertained whether they were actually accessions to the locality (stragglers of a night or off-shore migration, visiting the bay from temporary roosting places), or whether they were simply birds from rookeries a little lower down the coast and were enlarging their food-area by making daily excursions into the bay. On the 14th an incident happened that seemed to indicate that migration from the north was actually in progress in this species. A little company of young, headed by a fine adult, rounded Pt. Pinos during the morning and moved south. At the Point the young seemed to show a disposition to break away from the leadership of the old one, attempting several times to return into the bay, but each time the old bird got them straightened out by heading them off, and finally disappeared with them in line at his tail in the direction of Pt. Cypress. Also on the 14th, quite a number of Pigeon Guillemots were observed on the water and passing in and out of the bay, but no migratory movement was apparent, there seemingly being a lull in the migration of the species. Three or four California Murres were seen; two were on wing going southward. A Wan-

Western Gulls on the kelp. A few California Murres passed south on each of the three days, but none were seen on the water. A small flock of Killdeers was found one morning on the kelp, and Long-billed Curlews, on wing, began to be conspicuous about the bay. Both circumstances seem to point to migration, for there is general dispersion during migration, and birds are stranded in all sorts of situations after the passage of a migratory wave. Two Dark-bodied Shearwaters—the only ones noticed since the 9th—were seen on the 16th, following the shore line south.

The lull in the migration of California Murres, which began at the end of June, was broken July 19th, when solitary individuals and companies of less than half a dozen passed down the coast at short intervals during two hours I spent in the morning off Pt. Pinos. They shaped their course so that it brought them near to Pt. Pinos, then they diverged from the land, taking a direction that would carry them several miles out from shore as they passed Pt. Cypress. Not a single one was seen on the water. On the 19th also, it was very apparent that the adult Heermann's Gulls were more numerous than the Western Gulls or the immature Heermann's, an extensive inroad having taken place within a few days. There was a similar intrusion of adult Heermann's Gulls about the middle of July, 1892. Both instances furnish examples of migration indicated solely by increased abundance, as in neither case were the birds observed *in transitu*. A Dark-bodied Shearwater was shot and another was seen. Both were moving southward.

From the 20th to the 25th I did not make any observations, but my boatman, who was out each day, informed me that on the 20th and 21st a good many California Murres went down the coast, and that Pigeon Guillemots were more numerous than at any time since he had been with me.

On the 26th a few adult Marbled Murrelets appeared—the first of the season. They came from the northward in couples, and passed with great rapidity down the coast. There was quite a movement southward of California Murres, chiefly of individual birds. A few scattered Northern Phalaropes were also seen going south. A female that was taken displayed no signs of recent oviposition. It had retained more of the breeding plumage, however, than the one shot on the 11th.

The passage of individual California Murres down the coast continued on the 27th as on the 26th. One Murre, frightened by being shot at, turned upon its course and flew northward for some distance. Then it rose higher in the air, apparently to get its bearings, altered its course so as to head south again, and finally descended to the ordinary level of flight. This maneuver was resorted to a second time before it got fully in line with the southerly trend of the shore. The whole circumstance seemed to indicate that the bird recognized the landmarks, and was

Very little migration was observed on the 28th. It was confined to the California Murre and Northern Phalarope.

On the 30th conspicuous movements took place, particularly in the Marbled Murrelet and California Murre. Adults of the former species passed down the coast, singly and in couples, all the forenoon. The height of their movement was during the morning. They flew swiftly, and rounded Pt. Pinos chiefly between the buoy and the shore. No young birds were seen. The movement of California Murres was greater than at any time before during the season. Single birds and little strings were continually passing south, near the Point and far out, the whole time I was on the water. There appeared also to be a steady migration southward of California Brown Pelicans, though not on so large a scale by far as in the Murres and Murrelets. Northern Phalaropes showed a slight increase over former numbers. One large company and several small ones were observed, *en route* to the south.

July 31st there was a dense fog that lasted until noon. It had the effect to deflect the path of migration so that the birds came near to the shore. During half an hour, at eight o'clock, when the fog was densest, a large number of Dark-bodied Shearwaters on their way down the coast passed within a few hundred yards of the surf in front of the Seaside Laboratory. Among them was a Pink-footed Shearwater. It appeared to be bewildered by the fog. It was the first one of the season met with. No Dark-bodied Shearwaters were seen on the 26th and only one on each of the following days up to the 31st. These stragglers were all going south.

Quite a number of Northern Phalaropes were flying about at random during the forenoon of the 31st, apparently lost in the fog. Marbled Murrelets were moving down the coast as on the 30th, but not in such large numbers. There were some young ones among them. With the exception of a single trio, two adults and a young bird, the Murrelets flew in couples. There was some migration of California Murres, but not nearly as much as on the 30th. After the fog cleared away there appeared to be a decided migratory movement southward of Heermann's Gulls, small bands passing down the coast in frequent succession. They flew near the shore and rather high in the air. There was a directness and steadiness of flight not observed before. They appeared to be bent upon a journey, not merely going and coming from feeding grounds. As already stated, previous indications of migration in this Gull had been manifested solely by increased abundance, particularly noticeable in the adults. Four Pomarine Jaegers were seen after the fog. They followed the same path of movement as the Heermann's Gulls. A solitary Cassin's Auklet was taken. It was a female, apparently a breeding bird of the season. This species had not been noted before during the summer.

Conspicuous migratory waves occurred in the Dark-bodied Shearwater (on the 2d and 31st), in the California Murre (at intervals from the 19th to the 31st, high-water mark for June and July being reached on the 30th), in the Pigeon Guillemot (on the 9th, and probably on the 20th and 21st), in the Marbled Murrelet (on the 30th and 31st, especially on the 30th), in the Northern Phalarope (from the 27th to the 31st, forestalling the greater waves of August), in the California Brown Pelican (on the 30th), and in Heermann's Gull (on the 31st).

A notable feature in the migrations of July was the length of time when there were no migratory waves in the California Murre and Dark-bodied Shearwater, only passing stragglers occurring in either species.

August.—The greatest flight of Dark-bodied Shearwaters I observed during my stay occurred August 1st. There was no fog and they kept well away from the land. Three miles off shore they began to pass the boat in great numbers, and as far out as I could see at eight miles they were equally abundant. All passed rapidly down the coast as upon former occasions, except at midday when a few flew about at random, apparently temporarily halting in their migration. One was seen on the water. It was with a Black-footed Albatross. Accompanying the Dark-bodied Shearwaters were a white Fulmar, probably Rodgers's, and nine Pink-footed Shearwaters. The latter came straggling along at intervals, not more than two being seen together. Many Northern Phalaropes were observed two miles and outward from land. They flew up the coast as well as down, indicating that there was a pause in their migration also. Marble Murrelets were not numerous. Their path of migration was near the shore. California Murres were migrating as on previous days, but apparently in smaller numbers. They were all within three miles of the land. Three Pomarine Jaegers were seen, and an immature California Gull was taken, the first example of the season.

On the morning of the 2d two young Marbled Murrelets were found on the bay near the Seaside Laboratory, and quite a number of adults were seen on wing heading down the coast. Many young Pigeon Guillemots and some adults were on the water. They were very tame, and appeared to be tired birds resting after a night's migration.* Previously the adults had been very shy, usually taking wing out of reach of gun shot when the boat was turned toward them. Only three were seen off the water—an adult accompanied by two young. They were going south. Migration was slight in the California Murre on this day. Only a few were seen, and these *in transitu*. It was somewhat foggy and Dark-bodied Shearwaters, on their way down the coast, came within half a mile of the land. Not so many were noted as on the day before, and only two Pink-footed Shearwaters. An adult female Red Phalarope was captured alive. Northern Phalaropes were common, passing and repassing near Pt. Pinos there was a great gathering of them, evidently attracted by a school of "blue fish" that were leaping to the surface. As I came in from the ocean at two o'clock, a succession of small flocks passed the Seaside Laboratory, closely following the shore-line in the direction leading southward. On no previous day of the season was this species so abundant. In all situations the majority were dark birds, showing that the migration of the young was fully under headway. Young birds outnumbered the adults Aug. 1, 1892. Although it was foggy during the morning, the only Dark-bodied Shearwaters seen were one small flock and a few couples. Northern Phalaropes were common, but no rush took place. A female Surf Bird, apparently a bird of the year, was shot at Seal Rocks. Two others were with it. There was also a large flock of Black Turnstones on these rocks. The tide of migration was in the ascendency in the California Murre. Besides single birds and companies in indian file, one large wedge-shaped flock was seen, the first of the kind for the season. All came from the northward, passed quickly by, and disappeared to the southward, following the line of the coast in their flight.

On the 4th it was foggy during the morning, but afterward the fog retreated several miles out to sea, leaving a clear highway along the shore. Northern Phalaropes and California Murres were the only birds to appear in numbers to take advantage of it. Numerous small parties of the former species and some large ones came from the northward and passed down the coast. Migration in the Marbled Murrelet and Dark-bodied Shearwater was very feeble. Only a few individuals of either were noticed. Over two miles out from land several Surf Birds were seen flying southward. The Parasitic Jaeger was added to the list of the migrants from boreal regions, two individuals being noted. In 1892, one was taken and another seen on the first day of the month.

6th. When I reached the beach in the morning small flocks of Heermann's Gulls were passing down the coast at brief intervals, and also Western Gulls in fewer numbers. No movement of this kind had been observed before at so early an hour in the day. It was high tide on this day in the migration of Northern Phalaropes. There were large flocks, small companies, and single birds. Most of them were flying southward, following the shore-line, sweeping inward at Monterey Bay and outward after passing Pt. Pinos. Scarcely any were on the water, and comparatively few went up the coast. Many passed within a quarter of a mile of the shore, although there was no "low fog." Several small companies of Cassin's Auklets were found two or three miles out on the ocean. They were apparently the vanguard in the migration of this species in this vicinity, as but a single one had been met with before. Many solitary California Murres and little parties of half a dozen or less passed south. A bird of the year, under the charge of an adult, was capt-

They were apparently thoroughly tired out. Many were so weak of wing they struck the crests of the waves frequently in flying short distances to keep out of the way of the boat. Two young California Murres, each accompanied by an adult, were found five miles out from land in the direction of Pt. Santa Cruz. Quite a number of old birds were on the water, and many solitary ones and little parties in files were flying down the coast. A Pacific Fulmar—a female of the dark phase—was captured about three miles off shore. It was very lean and in very worn and faded plumage, and had apparently not bred during the season. Four or five miles out a good many Dark-bodied Shearwaters flew by the boat in a southward direction. Only one Pink-footed Shearwater was observed. Not so many Northern Phalaropes were encountered as on the day before.

There was almost a complete cessation of migration on the 8th, 9th, and 10th. Cassin's Auklets were not as abundant on the 8th as the day before. Between six and ten miles northwest of Pt. Pinos a good many little companies, however, were resting on the water. Fewer were seen on the 9th. They flew without difficulty. A considerable number of California Murres, in little groups, were on the ocean between Pt. Pinos and Seal Rocks on the 10th. A few Dark-bodied Shearwaters and one Pink-footed Sheawater were noted on the 8th. On the 9th, over ten miles northwest of Pt. Pinos, quite a number were seen flying eastward. A few others, nearer Pt. Pinos, were flying south. A few Northern Phalaropes were seen on the 8th and 9th. None of them were on the water, and as many went up the coast as down on the latter day. Only a small flock of Black Turnstones was at Seal Rocks on the 10th, the great flock that had been there having disappeared.

The 11th was one of the rare days when there was no fog, when the shore-line could be seen for miles. The sea too was calm. It was a day of great migration in Dark-bodied Shearwaters. They were passing Pt. Pinos all the forenoon about three miles off shore. The eye could follow them a long way as they came down the coast and disappeared to the southward. There were two almost continuous streams of them made up of straggling companies and loose flocks. At nine o'clock and again at eleven some of the latter were of such large size the two streams became merged into a single broad one at least an eighth of a mile in width. One of these flocks was estimated to be two miles in length. Leadership appeared to be exercised among them, for one of the birds, apparently seeing I was making havoc with my gun in a flock just in advance, left the flock he was in and flew back along the advancing column, and as he passed by the birds sheared off to the seaward, going past the boat out of range. The whole manœuvre was so obvious that my boatman, who had also been intently watching it, unconsciously to me, exclaimed, "that bird must be some sort of a general."

tion. After it had risen many Northern Phalaropes, chiefly in small flocks, passed down the coast. Dark-bodied Shearwaters were migrating in smaller numbers than on the 11th, and nearer to the land owing to the fog. There was quite a flight of California Murres, especially after the fog. A marked increase was noticeable in the size and number of the flocks of California Brown Pelicans coming into the bay in the morning from the direction of Pt. Cypress. A Pomarine Jaeger was shot, and four other Jaegers were seen.

14th. There had evidently been a migratory movement of adult Marbled Murrelets the night before or early on the morning of the 14th, for many pairs were found resting on the water between the Seaside Laboratory and the buoy, from half a mile to a mile off shore, during the forenoon. They did not attempt to fly, but dived to escape pursuit. Only one was observed on wing. On former occasions but very few had been seen upon the water. Several of the pairs were secured. The birds of each pair proved to be mated, one being a male and the other a female. They displayed strong attachment for each other. If one was shot the survivor would begin to call and look anxiously about for its mate, or if they became separated in diving, one would call and the other respond as soon as they came to the surface. A touching instance of fidelity occurred a few days before. A female had been shot and the male followed the boat as we returned to land, finally alighting near it and looking toward us in evident distress called piteously. Only three young Murrelets were noted. There was scarcely any migration in California Murres or Northern Phalaropes. Quite a number of the former, however, were on the water. But one Dark-bodied Shearwater was seen.

But little migration was in progress on the 15th and

16th. On the latter day more California Murres were found on the water than any time before during the summer. One flock numbered fully a score. Several young of the year were seen. Each one was under the guardianship of an adult. A male Pacific Fulmar of the dark phase was taken on the water well toward the eastern shore of the bay. Its plumage was bleached and worn, and new feathers were beginning to appear. The testes had apparently been dormant during the breeding season.

Migratory movement on the 17th was limited chiefly to the California Murre. Many were on the water, but the greater number were pursuing their way south. One flock of migrants had thirty in it. Four companies of White-winged Scoters in high black plumage came into the bay from the direction of Pt. Cypress during the forenoon. They were adjudged to be recent arrivals from the breeding grounds, because their general mien and their plumage was so entirely different from that of the ragged and faded birds found not far out from the surf along the sandy beaches earlier in the summer. In 1892 there was a similar appearance of these birds in high feather.

the fog wholly disappeared. Decidedly the greatest movement of California Murres during my sojourn took place on this day. During the first part of the forenoon great numbers were going down the coast within a few hundred yards of the surf. I spent several hours between the buoy and the outer rocks at Pt. Pinos watching them pass by. They moved chiefly in large wedge-shaped flocks, of greater size on an average than any previously seen. When the fog lifted we went out about three miles north of the buoy. Two miles from land and beyond great numbers of Murres were on the water, scattered about in large companies. They appeared to be very tired. Many tried to fly when approached, but most of these fell back upon the water after flying a few yards. Some of them did not rise high enough to keep from striking the water with their wings, and a high wave generally threw them back upon the water. One was discovered asleep with his bill tucked under his wing. He did not wake until the boat was almost upon him. A young bird with wings not developed sufficiently for flight, was taken. It was under the care of an adult. No other was seen.

Over two miles off shore, a male Rodgers's Fulmar was secured. It was flying about apparently searching for food. Its generative organs had the same degenerate appearance as those in the Fulmars previously taken. Its plumage was much worn. It was also moulting and new feathers were appearing. There was some migration in Dark-bodied Shearwaters. They appeared in twos, threes, and fours during the fog, passing within a few hundred yards of the surf between the Seaside Laboratory and buoy as they made their way down the coast. Two were resting on the water with the Murres. Many small companies of Northern Phalaropes were journeying southward. The fog also drove them inshore. They seemed to be confused by it. At the Point some hesitated and alighted on the water. They were apparently not tired, but afraid to venture out on the open ocean, for they took wing as soon as the boat approached them. Upon no previous occasion were so many seen on the water. Some flew back into the bay.

21st. No migration was observed in the California Murre. Only a very few were seen anywhere on the water, the great numbers of the day before having disappeared. Two California Gulls were taken — the second and third examples of the season. They were in the company of Western and Heermann's Gulls. Small parties of Dark-bodied Shearwaters, passing south, were found from two to five miles out from land, north of the buoy. There was quite a continuous flight of them. But one Pink-footed Shearwater was noticed. It was flying southward alone. Few Northern Phalaropes were seen.

22d. It was foggy in the morning and at intervals during the rest of the forenoon. Many Dark-bodied Shearwaters were following the shore-line south close to

Dark-bodied. They kept to themselves, however, appearing singly when there was a lull in the latter species. Northern Phalaropes did not occur in any numbers. There was a small flight of California Murres — of solitary birds and small squads. Some sixteen Pomarine and Parasitic Jaegers were seen. Three were taken at one spot. Quite a gathering of Gulls had collected there over several dead ones that had been thrown overboard as decoys. These in turn attracted a half-dozen Jaegers that were passing, an Arctic Tern, and two large Terns, probably the Royal. The fog had suddenly set in toward the south shore of the bay, deflecting migration, and putting the boat in the path of the Shearwaters and other birds migrating at the time. Among the Gulls that decoyed was a California Gull.

23d. A low fog closed down upon the bay and ocean at intervals during the entire forenoon, having the usual deflecting influence upon migration. Small flocks of Cassin's Auklets were going south all the forenoon. They rounded Pt. Pinos in the vicinity of the buoy. A few individuals were seen on the water. But little migration occurred in the California Murre. Several adults with young were on the water. There was considerable migration in Pomarine and Parasitic Jaegers. A single Long-tailed Jaeger was taken. Dark-bodied Shearwaters in small flocks were passing south during the whole forenoon. They were not nearly as numerous, however, as the day before. Many passed between the Point and buoy. There was a good deal of migration in Northern Phalaropes. When the fog was thickest, they showed a disposition to stop on the water. A notable event of the day was the capture of two Sabine's Gulls—an adult and a bird of the year. They were apparently migrating.

24th. I did not go out on the water until after nine o'clock. There was a heavy cross sea and a strong west wind. The sky was clear. It was hard work for my boatman to row against the wind, and most of the forenoon was spent in getting out to the buoy. A great many Northern Phalaropes were trying to make their way southward. They were following the south shore of the bay and had to breast the full force of the wind. Many became tired out, making short flights, stopping to rest between. The spirit of migration was strong in them. The wind blew so hard that the Brandt's Cormorants returning to their rookery could not keep in any order, but struggled against it in confused straggling flocks. Numerous flocks of Phalaropes were on the water just inside of the bay off Pt. Pinos. They were as mindful as we were to face the waves. If a white cap suddenly developed in front of them they flew lightly over it, immediately settling again on the water. A fine illustration of migration retarded by a strong head wind was afforded in this incident. There was no migration in other species. Perhaps the wind checked it.

25th. There was but little migration on this day, al-was surprised to find them within a few hundred yards of the beach near the Seaside Laboratory, flying out toward Pt. Pinos. Their large size and light-colored backs soon made it apparent that they were not Northern, but Red Phalaropes. At the buoy they were seen to turn Pt. Pinos and head south in the manner observed all along in other migrants. The majority were in small flocks. Some individuals, however, were migrating alone. Toward noon the flight began to subside, but none apparently stopped on the water. There was a greater flight of Northern Phalaropes. It continued without abatement as long as I was out on the water. Few of them came nearer to Pt. Pinos than half a mile. Four solitary Black-vented Shearwaters and one couple passed the boat, as it was stationed near the buoy, on their way down the coast. Their advent, seemingly portending the beginning of a migration later than that of their dark-bodied congener, was not wholly unexpected, for one was captured August 10, 1892. There was some movement in Dark-bodied Shearwaters. Its inner edge reached the buoy. A second Arctic Tern and two California Gulls were taken. The latter species was apparently becoming common. Several Surf Birds, proceeding southward, were seen out on the ocean near the buoy. Passing individuals had been observed at different times along since the 4th.

Few white-headed Western Gulls were seen toward the close of the month. Birds of the year and older immature ones, however, were numerous. The same remarks apply about as well to Heermann's Gull, for dark birds were almost the only ones met with toward the end of my stay. The two species seemed to become equal again in numbers at the last.

It was not satisfactorily ascertained whether any migration occurred in the Brandt's Cormorants breeding in the vicinity. There were fluctuations in abundance that may have been due not to shifting of fishing grounds, but to departure of adult birds and arrival of others later from further north.

The peculiar features of migration in August, as compared with July, were the larger number of birds that temporarily halted by the way, the greatly increased size and frequency of the waves, and the greater prominence of boreal species.

The additional northern birds to arrive were the Red Phalarope, Surf Bird, Parasitic Jaeger, and Pacific Fulmar (dark phase), during the first half of the month, and the Arctic Tern, Long-tailed Jaeger, and Sabine's Gull, during the second half.

Conspicuous migratory waves were observed in the following species:—

Dark-bodied Shearwater, on the 1st and 2d, the wave beginning July 31st and reaching its height on the 1st; on the 6th and 7th; on the 11th and 13th, the height of the wave perhaps occurring on Sunday, the 12th; from the 20th to the 23d, the height being reached on the 22d;

Pomarine and Parasitic Jaegers, on the 22d and 23d.

Red Phalarope, on the 27th, probably beginning on Sunday, the 26th.

The Western and Heermann's Gulls have been omitted from the list, as their fluctuations in abundance were not closely followed at the last.

Summary.—As has been shown by the facts presented, early southward migration was indicated by increased abundance in certain "summer species," by the appearance of species not previously observed, and by the passage of migratory waves, the birds being seen actually *in transitu*. As early as the latter half of June the tide of migration apparently began to set southward, migratory waves seemingly occurring in the California Murre and Dark-bodied Shearwater. During the first fortnight of July northern birds began to appear, the Northern Phalarope being the most notable example. There were extensive waves of "summer species," particularly during the latter part of the month. The closing days were signalized by conspicuous waves in the Marbled Murrelet and Northern Phalarope, and by the advent of the Pomarine Jaeger. During August the waves assumed much larger proportions and increased in frequency. Boreal birds became prominent, the waves of the Northern Phalaropes from the outset rivalling those of species summering in the region. The Sabine's Gulls, the Arctic Terns, and the wave of Red Phalaropes, appearing toward the close of the month, foreshadowed the great autumnal migrations that were to follow, as the Pomarine Jaeger, Marbled Murrelet, and Northern Phalarope, at the end of July, foreshadowed the movements of August.

While the general tendency was toward increase in size of the waves as the migrations advanced in a species, lesser waves also intervened between larger ones. Small waves were sometimes immediate forerunners of large ones. Individuals apparently preceded the first waves of northern species. Usually a large wave extended over several or more days, beginning gradually, reaching a day of maximum height, and then subsiding, being followed by a period when little migration took place in the species. With the progress of migration these lulls generally became of shorter duration, and were marked by increasing numbers of birds temporarily pausing by the way, resting upon the water or flying about at random. When a number of species were migrating at one time, it did not uniformly happen that the height of migration occurred upon the same day in each, for often the waves of some were waning while those of others were waxing. The California Murre typically exemplified early southward migration in species breeding in the region and the Northern Phalarope in species breeding in boreal regions.

"Barren birds" did not play an important part in the migrations, and young birds of the year did not precede the adults. In some instances young birds were found accompanying the adults, as in the Marbled Murrelet on

Shearwaters were guided on their journey by the land is shown by their conforming their course to the inward sweep of the shore-line at Monterey Bay, and by their deflecting their line of flight toward the land during dense fog.* The Brandt's Cormorants breeding in the neighborhood, and well acquainted with the surroundings, were not so dependent upon the land for guidance, finding their way readily in a fog over a placid sea from their fishing grounds to their rookery.†

Although the migrations in summer off Monterey are extensive, they are insignificant in comparison with the movements that follow in autumn.‡ Owing to the lack of proper situations for rookeries, there was not a large breeding population,§ and hence there could not be extensive movements in birds breeding in the immediate vicinity. The food-supply is temporarily very great in such a thinly populated region, being far in excess of the demands of the breeding colonies—a condition highly favorable for early southward migration. The area below the line of snow and ice in winter in North America is comparatively small. The vast region above this line, abounding in summer with the means of supporting bird life, must be largely depopulated before winter. Hence there is southward migration of birds—migration that extends even into a land of summer in the Southern Hemisphere. Winter also enforces depopulation of Arctic seas. In the lapse of time sea birds like the California Murre have seemingly learned, after the cares of reproduction are over, to move further south in the sparsely populated region of great food store, making room for the countless hosts that must leave the region of their birth before the chilling breath of winter has turned it into a region of desolation and famine.*

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* Shearwaters and other birds habitually flying near the surface of the water must from necessity migrate near the land if they desired to keep in sight of it, particularly in the region of such constant fogs as the vicinity of Monterey in summer. The coast at Pt. Santa Cruz, though mountainous and less than twenty-five miles away, was scarcely ever discernible from Pt. Pinos owing to the foggy state of the atmosphere.

† Pelagic migration of birds, especially in its relation to isolated oceanic islands, will be further considered in another paper, now in preparation.

‡ This is also the case in the smaller land birds in upper South Carolina. See "Auk," vol. ix, pp. 33-39.

§ Sea birds are necessarily very local on this coast during the season of reproduction owing to the isolated character of their breeding places. Certain species are found associated on some islets and not on others. Such distribution is probably due sometimes to lack of room, and not to actual scarcity in a species or to the physical conditions. All sea birds having the same breeding range cannot find habitation at one spot, no matter how favorable the situation may be.

GENERAL REMARKS ON THE BIRDS OBSERVED.

Only species of which specimens were taken are mentioned in the notes that follow. When no year is given, 1894 is to be understood. The determinations are based in most instances upon printed descriptions and are therefore in a measure provisional.

Æchmophorus occidentalis. WESTERN GREBE.—Toward the end of summer this Grebe became tolerably

Lunda cirrhata. TUFTED PUFFIN.—Individuals were quite common from the outset. Most of them appeared to be south bound migrants. I was told that a small breeding colony was located every year on an islet in Carmel Bay. The "Sea Parrots" apparently have a great deal of curiosity, for they were often observed to change their course when flying by so as to pass near the boat. One, on being shot at, flew back in the direction from which it came for a considerable distance; then it returned, passing close to the boat, and seemingly scrutinizing it.

In a male shot July 13th, the ear-tufts are very short, being worn off at the end. In another male, August 4th, one ear-tuft has entirely disappeared and several worn feathers alone remain of the other. Birds of the year, strong of wing, were observed as early as the first week of August.

Ptychoramphus aleuticus. CASSIN'S AUKLET.—So far as determined, Cassin's Auklet occurred only as a migrant. It was first noted July 31st.

Brachyramphus marmoratus. MARBLED MURRELET.—The Marbled Murrelet appeared early in July, but it did not become common until at the end of the month. With the exception of a single female taken August 15th, all the adults secured were in the "marbled" plumage. This female was nearly in complete winter garb. Its ovary did not have the appearance of recent functional enlargement, as was the case in the other females examined. This circumstance may account for its earlier assumption of the winter dress.

Brachyramphus hypoleucus. XANTUS'S MURRELET.—Of a Murrelet shot July 28th on the ocean three miles north of Pt. Pinos, Mr. Ridgway has written me: "—the bird is *Brachyramphus hypoleucus* with an unusually short bill. It is otherwise a normal *hypoleucus*." The tarsi of this specimen are scutellate in front—as distinctly scutellate as in *Synthliboramphus antiquus*. This record apparently extends the known range of this species, for I find no mention in the general literature of its occurrence so far north.

Cepphus columba. PIGEON GUILLEMOT.—This species was rather common at Monterey Bay upon my arrival. It increased in abundance with the progress of the migrations. A breeding colony was apparently established on the south side of Carmel Bay at the time of my visit, June 25th, for fifty or more adults suddenly appeared from the water's edge of the rocky islets along the shore when I fired my gun. Before not one had been in sight. A party of Stanford University students found a nest with young the day following in the same locality.

Uria troile californica. CALIFORNIA MURRE.—Although a common bird during the latter half of June, the California Murre was apparently only a migrant in the vicinity of Monterey in summer. As has already been and flapping their wings, apparently to free the plumage from water.

Stercorarius pomarinus. POMARINE JAEGER.—During August of both seasons this Jaeger became quite common. In 1892, it was first detected August 1st, and in 1894, July 31st.

Stercorarius parasiticus. PARASITIC JAEGER.—Nearly the same remarks apply to this species as to the preceding one. It was not positively identified, however, the second season before August 4th.

Both Jaegers were very bold. Often they would decoy to Gulls thrown overboard to attract them. Several times individuals came and hovered over the boat for a moment, apparently drawn by the dead birds plainly in view in it. They did not linger, however, over wounded companions as did the Gulls. Upon one occasion three of them tried to capture a small bird that was flying over the bay not far out from the shore. Although their attack was a concerted one, the bird succeeded in dodging them and keeping above them, finally escaping to the land.

Stercorarius longicaudus. LONG-TAILED JAEGER.—August 23d an adult male Jaeger was obtained that is apparently this species. The tarsi were light bluish in life, in marked contrast with the black of the toes. In drying the color of the tarsi has become olivaceous. The slate-gray of the under tail-coverts prevails over the abdomen. The nasal shield and unguis are about equal in length.

So far as I am aware this species has not been previously reported from California.

Larus occidentalis. WESTERN GULL.—With the exception of the Brandt's Cormorants, the Western Gulls are the most prominent birds of the bay during the early part of summer. Later, although increased in abundance, they are overshadowed, for some weeks at least, by the Heermann's Gulls. No Gull rookeries were discovered. The beds of kelp growing along the shore of the bay a short distance out from the surf were favorite resting-places for both Western and Heermann's Gulls. They freely associated on the kelp and elsewhere. On the rocks and on the open water, especially where there were schools of fish, Brandt's Cormorants and California Brown Pelicans were found in their society. Often great congregations of Gulls and Cormorants were formed where the fishing was good. Both Gulls were very unsuspicious as a rule, and allowed the boat to draw quite close before taking wing. They invariably decoyed when dead birds were thrown out on the water to lure them, large flocks as well as solitary birds being attracted.

Larus californicus. CALIFORNIA GULL.—The first one was noticed August 1st. Toward the close of the month they became somewhat common. They were found in company with other Gulls.

Larus heermanni. HEERMANN'S GULL.—Immature

Individuals began to moult as early as June. Most of the mottled-headed birds of the first part of August had only partially grown tails. Many of them appeared to be fork-tailed, two of the old outer feathers remaining.

Xema sabinii. SABINE'S GULL.—An adult (apparently a male) and a female bird of the year were obtained August 23d. They were decoyed within range with dead Gulls. In the adult, some white feathers show in the plumbeous of the head and upper part of the neck. Otherwise it appears to retain the full summer plumage. Mr. Bryant has recorded a previous specimen from California in "Zoe," vol. iii, p. 165. This specimen is No. 379 of the collection of the California Academy of Sciences. It is a bird of the year, and is labelled "San Francisco Bay, Cal., Oct. (10?), 1889;" "From E. F. Lorquin."

Sterna paradisæa. ARCTIC TERN.—Two females were taken—one, August 22d, the other, August 27th. The former is apparently in summer plumage, but the latter has white mixed with the black on the top of the head.

Diomedea nigripes. BLACK-FOOTED ALBATROSS.—On the 1st of August two Black-footed Albatrosses were secured about eight miles north of the buoy. These were the first observed. During the rest of my sojourn individuals were seen every few days, one of them within half a mile of the buoy. They were very unsuspicious. One bird, sighting the boat a long way off, came directly toward us and alighted on the water about a hundred yards away. It sat there motionless until dispatched at very short range. Another, quite a distance off, changed its course immediately when a couple of Gulls were tossed into the air to attract it, and headed in a bee-line for the boat, only stopping in its career when cut down, scarcely fifty feet away.

Diomedea albatrus. Short-tailed Albatross.—June 18th an adult male was shot near the Chinese fishing village at Monterey. It was evidently a straggler that had sought safety within the bay on account of its disabled condition, for the outer primaries of the left wing were broken off and the feet bore the marks of gunshot wounds, long healed. It was very tame, and flew only a short distance when pressed.

Fulmarus glacialis glupischa. Pacific Fulmar.—As has been stated in a previous part of this paper, three examples of the dark phase were taken in August—on the 7th, 11th, 16th.

Fulmarus glacialis rodgersii. Rodgers's Fulmar.—A Fulmar with plumage greatly bleached, shot July 12th, appears to be this subspecies, and not a faded example of the light phase of *glupischa*. A specimen, procured August 20th, is undoubtedly typical *rodgersii*, it having enough fresh fall plumage for satisfactory determination. July 2d and August 1st and 17th, three other white Fulmars were seen.

Puffinus griseus. DARK-BODIED SHEARWATER.—After the 16th of June this Shearwater apparently occurred only as a south bound migrant. During the passage of its migratory waves it was very abundant. It was observed both years. A series of forty-seven specimens was secured the second season.

Phalacrocorax penicillatus. BRANDT'S CORMORANT.—The going and coming of the "Shags" in their fishing excursions into the bay from their rookery at Seal Rocks is the most striking feature in the bird life of the vicinity of Monterey during summer. They were abundant in 1892 and still more abundant in 1894. The latter year, also, wedge-shaped flocks were formed earlier and more birds were found at the outset on the rocks along the shore.

Sometimes solitary Cormorants returning to their rookery joined the files of migrating California Murres, and frequently single Murres were observed bringing up the rear of strings of outgoing Cormorants. On one occasion a California Brown Pelican was seen at the end of a line of Cormorants.

Great rafts of these Cormorants collected on the bay whenever "the feed came in." At the distance these gatherings present a very peculiar appearance. The water seems to be thickly set with black sticks, often covering an area of several acres. Gulls, particularly, congregate with the Cormorants upon such occasions.

Two rookeries were discovered; one at Pt. Carmel, and the other at Seal Rocks. June 25th I visited the former, which is situated on a rock, or little islet, in the ocean at the extremity of Pt. Carmel, about fifteen yards from the mainland. This rock rises perpendicularly some forty or more feet above the water. At first sight it does not seem that it can be scaled, but closer inspection reveals that a foothold may be had in the seams and protuberances on its water-worn sides. Only on days when the sea is very calm can the rock be landed upon, and then only from the sheltered channel separating it from the mainland. Fortunately, it happened that the sea was quiet the day of my visit. The following day a party of Stanford University students were unable to land on account of the heavy surf.

We first took a view of the rookery from the mainland. The Cormorants were very tame, remaining on their nests while we clambered down the sloping rocks, and while we stood watching them, on the same level, only a few yards away. They were safe, however, from nearer approach, the deep though narrow channel with its precipitous walls of rock, effectually cutting off further advance. They were equally tame when the boat drew near, as we approached from the water.

The clefts in the sides of the rock were occupied by Baird's Cormorants and the top by Brandt's. There were comparatively few of the former, but of the Brandt's Cormorants there were upwards of two hundred pairs.

quent numbers were therefore three and four, probably the ordinary clutches.

"Sardines"* were lying in little bunches near the nests, apparently placed there as food for the birds that were setting.

The smell from the accumulated excrement was sickening. The sides of the rock were so daubed that it appeared to be white toward the top. Flies swarmed about the rookery.

It was not until I fired my gun that the brooding birds began to desert their eggs. The Baird's Cormorants were the first to go. Many of the Brandt's Cormorants lingered on the edge of the rock while I walked about among the nests, only a few steps away. Finally all were driven to the water, where they formed a great raft. They began to return as soon as I left the top of the rock.

The rookery at Seal Rocks was much larger than the one at Pt. Carmel. The rocky islet upon which it was located is considerably greater in size and much lower in elevation than the Pt. Carmel islet. From the mainland, less than a hundred yards distant, no nests were in sight, all being on the side toward the ocean, hidden from view by a sort of dividing ridge. The Del Monte drive passes along the shore directly opposite the Rocks. It is a much frequented roadway, and the summer visitors have greatly persecuted the birds with firearms, forcing them to seek shelter for their nests behind the protecting rock.

My first visit to the rookery was made July 2d. As at Pt. Carmel, a landing could be effected only on the shore side of the islet. The resident population was composed exclusively of Brandt's Cormorants. Their nests were crowded so closely together on the uneven surface of the rock that room to place the foot was not always readily found. Some of the nests were on little points of rock, others in crevices, every available spot being utilized. Most of the eggs had hatched. The young were in different stages of growth, varying in size from those just out of the shell to half-grown ones. The larger left the nests when approached, and huddled together on the edge of the islet well above the reach of the surf. There was such a complete mixing up of babies that the old birds must have had some trouble in sorting them out when they returned, for immediately after I landed most of the adults retreated to the water, congregating in a great raft a short distance away. A few of the bolder remained behind for awhile. Several, apparently females, kept close by their young until I approached within ten feet of them, when their courage failed and they took flight, leaving the young to shift for themselves. Two of the larger young birds sought refuge on an outlying rock, separated from the islet by a little channel.

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* Dr. Charles H. Gilbert kindly identified the "sardines" taken from the gullets of the Brandt's Cormorants during the summer of 1892. They proved to be a species of Rock Cod—*Sebastodes paucispinis*.

taining the larger young were trampled down. Two typical, untrampled nests yielded the following measurements, in inches:

Outer diameter	22	19
Inner diameter	10	10
Depth	4	4
Height	5½	7

Not many fish were lying about the nests. There were too many hungry mouths to be filled for a store to accumulate as at Pt. Carmel rookery.

It was evident that sanitary measures were not in vogue, for the decaying bodies of several birds were suffered to remain and add to the almost intolerable stench of the excrement deposits. Quantities of feathers were scattered about and there were myriads of flies. Some of the flies accompanied us in the boat most of the way to Pt. Pinos, much to our annoyance.

On the 27th of July all the young observed during previous visits were apparently still on the islet. There were also a few eggs and a few young recently hatched. When I drew near them, the older of the young birds crowded to the edge of the islet and many of them tumbled into the water, where they seemed to be as much at home as their parents.

Phalacrocorax pelagicus resplendens. BAIRD'S CORMORANT.—Save a solitary one seen July 5th about a mile south of Pt. Pinos, the only Baird's Cormorants observed were those at the Pt. Carmel rookery. There were some twenty pairs nesting in the crevices on the sheltered sides of the rock facing the mainland. They were inclined to keep apart from the Brandt's Cormorants, most of them retreating to a rocky point on the mainland instead of joining the raft of Brandt's Cormorants on the water. They were shyer than their larger congener. All had the white patch on the flanks, but in some it was larger than in others. No young birds were discovered. The eggs examined, however, appeared to be well advanced toward the hatching point.

Pelecanus californicus. CALIFORNIA BROWN PELICAN.—In June it was rather common. Through July and August it increased steadily in abundance, toward the last becoming one of the most conspicuous birds of the bay.

Histrionicus histrionicus. HARLEQUIN DUCK.—On July 7th an adult male, on its way down the coast, was captured as it was rounding Pt. Pinos. It was followed a short time after by a second individual.

Oidemia deglandi. WHITE-WINGED SCOTER.—Both seasons White-winged Scoters were quite common off the sandy beaches during the latter half of June. They were present at intervals during July and August. During the closing half of August birds apparently began to arrive from the breeding grounds.

Fulica americana. AMERICAN COOT.—A few apparently bred at a lagoon behind the dunes, about a mile north of Monterey, for they were found there the middle of June.

Crymophilus fulicarius. RED PHALAROPE.—One was handed to me alive on the morning of August 2d. I was told that it swam into the little cove at the Seaside Laboratory and climbed upon a rock, where it was struck with an oar and captured. It was an adult female, and retained much of the nuptial plumage. It was apparently in good health. An adult male was taken on the 25th. On the 27th an extensive wave of these Phalaropes passed the vicinity of Monterey.

Phalaropus lobatus. NORTHERN PHALAROPE.—Appearing July 11th, the Northern Phalarope became very abundant during August as a transient migrant.

Ereunetes occidentalis. WESTERN SANDPIPER.—A male in high plumage was taken July 18, 1892, on the beach north of Monterey. It was with a company of Snowy Plovers.

Symphemia semipalmata inornata. WESTERN WILLET.—About two miles north of the buoy a female was secured August 17th from a company of three that were flying toward Pt. Santa Cruz. A small flock going in the same direction was seen on the 20th near the same spot.

Heteractitis incanus. WANDERING TATLER.—This Sandpiper was not discovered breeding either season. The first were observed about the middle of July. They became very common at the end of that month, frequenting the rocks just above the surf.

Numenius longirostris. LONG-BILLED CURLEW.—In July, Long-billed Curlews on wing began to be conspicuous about the bay, evidencing that the nesting season was drawing to a close and migration was under headway.

Ægialitis vocifera. KILLDEER.—Killdeers were quite common both summers in marshy situations.

Ægialitis nivosa. SNOWY PLOVER.—In 1892, Snowy Plovers were found commonly on the sandy beaches. The last of June of that season fully fledged birds of the year were abroad. A female taken July 4th contained ova nearly ready for the shell.

Aphriza virgata. SURF BIRD.—Besides three found at Seal Rocks on the 3d, a few passing migrants were noted at intervals during August.

Arenaria interpres. TURNSTONE.—A female was captured July 18, 1892, on the beach about a mile to the northward of Del Monte.

Arenaria melanocephala. BLACK TURNSTONE.—Black Turnstones were first met with on the 2d of July, about a

COLEOPTERA OF BAJA CALIFORNIA.

(SUPPLEMENT I.)

BY GEORGE H. HORN.

[With Plate xx.]

The following additional account of Coleoptera from the Cape Region of Baja California is the result of the examination of new collections received from the California Academy of Sciences since the publication of my last paper. The result is the addition of fifty-two species, half of which are new. The collections were made by the expedition sent out by the Academy to the Cape Region and the Pacific mainland of Mexico during the month of September, 1894.

One of the most interesting in the matter of distribution is a specimen which I am compelled to refer to *Calosoma Sayi*, unfortunately a female and without legs. The discovery of the male may prove it to be a distinct species.

This as well as the former collections from the Cape Region of Baja California contains a few species identical with those from the Pacific mainland of Mexico, indicating the varied origin of the Cape Region fauna. The types will be found in the collection of the Academy of Sciences in San Francisco.

CARABIDÆ.

*CALOSOMA SAYI Dej. The unique female is rather smaller than those found in the States. Pennsylvania to Texas. San José del Cabo.

DYSCHIRIUS TRUNCATUS Lec. Colorado, Nevada, California, Arizona. San José del Cabo.

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*On the day after the proof-sheets of these pages left me a male of the *Calosoma Sayi* was received, enabling me to state with certainty that it agrees in all details with the forms from the Atlantic region.

Bembidium jucundum n. sp. San José del Cabo, Sierra San Lazaro.

Pristonychus complanatus Dej. More decidedly black than the specimens from California. Probably introduced through commerce. Europe, California. San José del Cabo.

Euphorticus pubescens Dej. The unique example is of the Central American type mentioned by Bates in which the surface is decidedly brassy and the thorax slightly broader with more arcuate sides. Occurs from North Carolina southward through Mexico to Santa Catharina, Brazil. San José del Cabo.

Tetragonoderus pallidus Horn. San Diego, Cal., Tucson, Ariz. Sierra El Taste.

Tetragonoderus fasciatus Hald. Eastern United States from Michigan southward, Texas, Arizona, southern California. San José del Cabo.

Apenes lucidula Dej. The specimen referred to this name is duller than usual and the surface sculpture better marked. From the method of variation of the

SILPHIDÆ.

Silpha truncata Say. Kansas, New Mexico. Sierra San Lazaro.

SCYDMÆNIDÆ.

Eumicrus lucanus n. sp. Arizona. San José del Cabo.

COCCINELLIDÆ.

Scymnus collaris Mels. Canada to Texas. San José del Cabo.

Scymnus cinctus Lec. (*suturalis* Lec.) Louisiana westward to Los Angeles. San José del Cabo.

Scymnus ardelio Horn. Separated by me from the series formerly called *marginicollis* from which it differs in usually red legs and the absence of tubercle on first ventral of male. California, Arizona. San José del Cabo.

CRYPTOPHAGIDÆ.

Tomarus bisignatus n. sp. San José del Cabo.

DERMESTIDÆ.

Attagenus piceus Oliv. Cosmopolitan. Sierra San Lazaro.

HISTERIDÆ.

Paromalus (Carcinops) **viridicollis** Mars. To this is referred *P. mimeticus* Horn. Arizona, Mexico. Sierra Laguna.

Saprinus oregonensis Lec. The unique differs from typical forms in having the punctures of the apex less extended toward the humeri. Oregon, California. Sierra San Lazaro.

DASCYLLIDÆ.

Scirtes humeralis n. sp. San José del Cabo.

ELATERIDÆ.

HORISTONOTUS DENSUS Lec. Sierra San Lazaro and San José del Cabo.

LAMPYRIDÆ.

MALTHODES LUCANUS n. sp. San José del Cabo.

TELEGEUSIS DEBILIS n. g., n. sp. Sierra San Lazaro.

CLERIDÆ.

CREGYA VETUSTA Spin. Pennsylvania to Missouri. San José del Cabo.

HYDNOCERA DISCOIDEA Lec. Very variable in its coloration. Texas, Arizona. Calmalli Mines and Sierra San Lazaro.

PTINIDÆ.

GIBBIUM SCOTIAS Scop. Europe, Atlantic States. San José del Cabo.

PITNUS PYGMÆUS Ghm. By error this appears in the previous list as a Ptinus.

PASSALIDÆ.

NELEUS TLASCALA Perch. Mexico. San José del

CHRYSOMELIDÆ.

Lema trilineata Oliv. Atlantic States, Texas, Arizona, Mexico. San José del Cabo.

Lema omogera Horn. This species varies with the elytra entirely yellow.

Griburius montezuma Suff. The generic name Scolochrus is adopted by European authors, although three years posterior to Haldeman's name. Suffrian (Linn. Ent., vii, p. 104) suppresses the older name for no valid reason. Arizona, Mexico. San José del Cabo.

Metacolaspis conspersa n. sp. San José del Cabo.

Colaspis mœsta n. sp. San José del Cabo.

Blepharida atripennis n. sp. San José del Cabo.

Calligrapha ancoralis Stal. Mexico, Sierra San Lazaro.

Crepidodera peninsularis n. sp. San José del Cabo.

Psylliodes convexior Lec. Atlantic States, Texas, Nevada and California. San José del Cabo.

BRUCHIDÆ.

Bruchus distinguendus Horn. Florida, Arizona. Sierra San Lazaro.

TENEBRIONIDÆ.

Triphalus cribricollis n. sp. Miraflores.

Eurymetopon punctulatum Lec. By an oversight, this species appears twice on page 347 of my previous paper.

ANTHICIDÆ.

Xylophilus brunnipennis Lec. Canada, Georgia, Arizona, California. El Taste, La Paz.

MELOIDÆ.

Macrobasis languida n. sp. San José del Cabo.

CURCULIONIDÆ.

CLEONUS QUADRILINEATUS Chev. Kansas, Texas, New Mexico, Arizona. Sierra San Lazaro.

OTIDOCEPHALUS ALTERNATUS n. sp. La Paz.

OTIDOCEPHALUS SPARSUS n. sp. Cape Region, probably.

CONOTRACHELUS LUCANUS n. sp. San José del Cabo.

ZASCELIS OBLONGA n. sp. Arizona. Sierra San Lazaro.

COPTURUS SOBRINUS n. sp. La Paz, Sierra San Lazaro, Sierra El Taste.

SCOLYTIDÆ.

XYLEBORUS sp. Closely related to *xylographus*, and a little larger. One specimen. San José del Cabo.

DESCRIPTIONS OF NEW SPECIES.

The following pages contain descriptions of those indicated as new in the preceding list, together with notes on some previously recorded. I have availed myself of the kind permission previously accorded by the publication committee and have added descriptions of a few species oblong oval, one-third longer than wide, humeri obtuse, disc feebly convex, striæ composed of moderate punctures not closely placed, obliterated at apical third, sutural stria at apical half and the eighth impressed, the latter distant from the margin, third interval finely bipunctate, punctures near the third stria. Body beneath smooth and shining. Legs and coxæ yellowish testaceous. Length, .14 inch; 3.5 mm.

This pretty little species belongs to the group xv, as defined by Dr. LeConte (Proc. Acad. Phil., 1857, p. 5), containing *axillare*, *quadrimaculatum et al.*, to which group *B. sphærodcrum* and *cyclodes* Bates (Biol. 1, pp. 147 and 290) probably belong. In fact, the present species seems closely allied to *cyclodes*.

Two specimens. San José del Cabo and Sierra San Lazaro.

CYMINDIS CALIFORNICA n. sp.

Piceous feebly shining, elytra paler, legs testaceous. Antennæ brownish, basal joint paler. Head not closely punctate. Thorax distinctly broader than long, trapezoidal, sides arcuate in front, slightly sinuate posteriorly, hind angles distinct, not prominent, side margin not translucent nor reflexed, disc very feebly convex, coarsely punctate at sides and base, more sparsely at middle, median line fine, sutural margin with three setæ, the middle one short. Elytra very finely striate, striæ with fine indistinct punctures, intervals flat, indistinctly alutaceous and with one series of irregularly placed punctures, each with a very short hair. Body beneath piceous, very sparsely punctate. Length, .30 inch; 7.5 mm.

A small species without translucent side-margin to the thorax and with the thorax very distinctly wider than long. It is therefore more allied to *unicolor* than any other in our fauna. The latter has, however, but one lateral setigerous puncture and the side margin of thorax distinctly reflexed and the disc convex and coarsely closely punctate. The elytral intervals are also closely punctate. In the present species the side margin of the thorax is not at all reflexed and the disc as flat as in *Apenes nebulosa.*

One specimen. San Luis Obispo. (Chas. Fuchs.) This is the first instance of the occurrence of Cymindis in California.

APENES LIMBATA n. sp.

Form of *nebulosa*, head and thorax rufo-testaceous, elytra piceous with a broad lateral pale margin, a humeral lunule and a somewhat sinuous band near the apex testaceous. Antennæ pale. Head finely rugulose and sparsely finely punctate. Thorax alutaceous, faintly wrinkled and very sparsely punctulate, median line distinct from base to apex. Elytra with fine striæ, finely punctulate, intervals distinctly alutaceous, sparsely minutely punctulate. Body beneath and legs testaceous, abdomen piceous, paler at middle. Length, .30 inch; 7.5 mm.

The pale lateral border covers the outer three intervals. The humeral lunule is like that of many Cicindelæ. The

HYDROCHARIS RICKSECKERI n. sp.

Oblong oval, slightly broader behind the middle, form of *castus*, beneath black, above piceous with olivaceous tinge, margin of thorax and elytra yellow. Antennæ, legs and palpi yellow, the trochanters piceous. Head finely punctulate. Thorax finely punctulate with three groups of coarse punctures, one near the front angle, a second oblique line each side of middle in front, a third more numerous from the middle of the side obliquely backward. Elytra minutely punctulate with the usual series of coarse punctures. Prosternum not prolonged at apex. Tarsal claws abruptly bent, with a broad lobe at base. Length, .46 inch; 11.5 mm.

The yellow lateral border of the thorax is narrow and well defined, that of the elytra broader but not sharply limited.

One specimen. Harris' Pond, near Santa Rosa, Cal. Ricksecker.

The species of Hydrocharis, four in number, equally divided between the Atlantic and Pacific regions. They are as follows:

Prosternum prolonged in point behind the coxæ.	
Maxillary palpi long.	***castus.***
Prosternum not prolonged.	
Piceous with entire border yellow.	***Ricksеckeri.***
Piceous slightly bronzed.	***obtusatus.***
Surface pale glaucous green.	***glaucus.***

CERCYON RUFESCENS n. sp.

Oval, convex, form of *tristis*, rufescent moderately shining. Head and thorax sparsely finely punctate. Thorax without basal marginal line. Elytra without impressed striæ but with rows of moderate punctures not closely placed, the eighth, ninth and tenth rows with the punctures deeper and closer for part of their length; intervals flat, equal in width, irregularly biseriately punctate. Body beneath colored as above. Metasternal area not well defined, moderately coarsely punctate. Mesosternum oval, acute in front, coarsely punctured. Prosternum strongly carinate. Length, .08 inch; 2 mm.

From its form and the fact that the head is vertical the species seems best placed near *tristis* and *floridanus*, but it differs from all of that series by its pale color, which is not due to immaturity. At first glance it would be taken for an Olibrus.

One specimen. Sierra San Lazaro.

Anisotoma Merkeliana n. sp.

Oval, slightly oblong, moderately robust, piceous black, shining. Antennæ rufo-testaceous, the outer three joints piceous. Head sparsely punctate but with four large vertical punctures in a transverse row. Thorax more than twice as wide as long, sides strongly arcuate, hind angles broadly rounded, disc sparsely punctate with a few coarse punctures along the base. Elytra moderately coarsely striato-punctate, intervals flat, minutely sparsely punctulate, the intervals 3–5–7–9 with the usual series of very coarse distant punctures. Body beneath piceous

EUMICRUS LUCANUS n. sp.

Reddish brown, sparsely clothed with paler, semi-erect hair. Antennæ slender longer than half the body, fifth joint as long as the preceding two and slightly longer than the two following. Head shining, very minutely sparsely punctate. Thorax longer than wide, apex narrower than base, sides regularly arcuate, widest one-third from apex, disc convex, sparsely and minutely punctulate, at base moderately quadrifoveolate. Elytra not wider at base than the thorax, a slight depression within the humeri, widest at middle, disc convex, surface indistinctly punctulate. Tarsi slender, longer than half the tibiæ. Length, .06 inch; 1.5 mm.

The male has the anterior tarsi slightly dilated.

This species is evidently allied to *commilitonis*, as described and figured by Dr. Sharp (Biol. II, pt. 1, p. 67, pl. 2, fig. 22), but is of more elongate form and with more slender antennæ.

One specimen. San José del Cabo, with which I associate two from Arizona in my cabinet.

There are now six species of this genus known in our faunal limits—*grossus*, *Motschulskii*, *vestalis*, *Caseyi*, *lucanus* and *Zimmermanni*. The latter species has for a synonym *punctatus* Casey. The genus Cholerus has, in Mexico, half more species than Eumicrus, but none are yet known to me from our fauna. *E. Caseyi* Brend., which is unknown to me, is remarkable in its polished surface.

PIESTUS EXTIMUS Sharp (Biol. I, pt. 2, p. 713).

Through the kindness of Mr. Ricksecker I have a specimen which I refer to this species, collected in Arizona. The type is from Chihuahua. *P. erythropus* Er. is said by Fauvel (Bull. Soc. Linn., Norm., ix, p. 29) to have occurred at Opelousas.

ZALOBIUS Lec. Trans. Am. Ent. Soc. v, p. 49, March, 1874.

This genus is introduced with the desire to give sketches of the head and thorax of the two known species. At the same time some additional characters will be made known and a new form allied to Zalobius described.

The two species differ greatly in the form of the thorax, as will be seen by reference to the plate. On both the disc is quadricostate, the costæ abbreviated and indistinct in *spinicollis*, entire and well marked in *serricollis*.

The terminal joint of the maxillary palpi is scarcely twice as long as the third joint, although Dr. LeConte gives it greater length. The gular sutures coalesce at their middle, forming but one, as will be observed in all the genera in our fauna of the sub-tribe Coprophilini, of which Zalobius is a member, as stated by LeConte. The outer five joints of the antennæ are described as rather abruptly wider (Class. Col. N. A., ed. 1883, p. 103), while in Syntomium but three joints are so. While this character is fairly good, it will be observed that the structure of the joints themselves affords a more certain

These characters have been passed in review with the view of suggesting a modification of the arrangement of the genera of Coprophilini as represented in our fauna. In the table of the classification above quoted the "Oxytelini genuini" and "Coprophilini," as defined by Erichson (Staph., p. 30), have been included in one group, Oxyteli, but it now seems to me better to revert to the Erichson method and separate the genera with five-jointed tarsi from those with but three.

The genera may be arranged in the following manner:

Tibiæ spinulose on the outer edge.
  Antennæ gradually thicker, the outer five joints with sensitive punctuation and pubescence. ***Coprophilus.***
Tibiæ not spinulose.
  Maxillary palpi rather short and stout, the terminal joint shorter than the third. Antennæ with three outer joints obviously wider. ***Syntomium.***
  Maxillary palpi rather slender and elongate, the terminal joint longer than third.
Gular sutures confluent at middle.
  Middle coxæ cavities confluent. Antennæ not stouter externally. Elytra not costate. ***Deleaster.***
  Middle coxæ cavities distinctly separated.
    Antennæ with outer five joints stouter. Elytra distinctly costate. ***Zalobius.***
Gular sutures separated their entire length. Middle coxæ cavities separated.
  Maxillary palpi very slender. Outer four joints of antennæ stouter. Elytra costate. ***Asemobius.***

Zalobius is represented by two species.

ZALOBIUS SPINICOLLIS Lec. Trans. Am. Ent. Soc., v, 1874, p. 49.

Occurs from Vancouver southward to Santa Clara (Ricksecker). Pl. xx, fig. 8.

ZALOBIUS SERRICOLLIS Lec. Loc. and cit., 1875, p. 170.

Collected by me at Fort Tejon, not Owens Valley, as stated by LeConte. Pl. xx, fig. 9.

ASEMOBIUS n. g.

Form elongate, much depressed, surface moderately shining. Head moderate in size, scarcely longer than wide, slightly prolonged behind the eyes, very abruptly constricted, the occiput not elevated transversely at the constriction. Mandibles moderately prominent, acute at tip, toothed at middle. Labrum transverse, truncate. Maxillary palpi long and slender, the last joint a little longer than the third. Antennæ slender, first joint cylindrical, stout, second shorter and more slender, third very slender and nearly as long as the first two, joints four to seven equal in length, slender, slightly thickened at their distal end, joints one to seven glabrous with few hairs, joints eight to ten quadrate, broader, eleventh more elongate, joints eight to eleven densely punctulate and pubescent. Prothorax with sides explanate and serrate. Elytra quadrate, emarginate at base, apex truncate, acutely notched each side, disc costate. Abdomen depressed, gradually narrowed to apex, sides widely margined. Middle coxæ separated. Legs slender, tibiæ not spinulose. Tarsi slender, joints one to four nearly equal, fifth as two-thirds, the latter the entire length of elytra. Abdomen longer than the elytra, sparsely punctate, with short golden hairs. Prothorax beneath with few very coarse punctures at middle, polished at the sides, abdomen sparsely punctate gradually more closely to apex. Length, .17 inch; 4.5 mm. Pl. xx, fig. 10.

Male. Last ventral with a deep oval emargination, the face of the segment slightly flattened.

The genus Asemobius proposed above is allied to Zalobius, but differs in having the gular sutures separated and by the terminal joint of the maxillary palpus scarcely longer than the preceding joint. The occiput may be retracted under the apical margin of the thorax, but in Zalobius the occiput is elevated above the neck, so that it applies against the edge of the thorax.

One specimen. California without special locality, but I think given me by Mr. L. E. Ricksecker.

TOMARUS BISIGNATUS n. sp.

Pale fusco-testaceous, each elytron with a small piceous spot centrally placed, form of *pulchellus* but somewhat more acute behind, surface with moderately coarse pubescence. Head moderately coarsely, not closely punctate.. Thorax twice as wide as long, slightly narrower at apex, sides moderately arcuate, disc convex more coarsely and less densely punctate than the head, basal foveæ well marked. Elytra punctate, the punctures somewhat larger and more distant than those of the thorax, very much finer and nearly obliterated at apex. Body beneath darker than above, sparsely finely punctulate. Legs pale. Length, .06 inch; 1.5 mm.

Camp Grant, Arizona; San José del Cabo.

The species of Tomarus are not numerous and may be distinguished in the following manner:

Elytra coarsely punctate, pubescence coarse.
  Margin of thorax continuous; each elytron with a small piceous spot at center. *bisignatus.*
  Margin of thorax irregular; each elytron with a piceous incomplete band at middle, a piceous area near the apex. *hirtellus.*
Elytra finely punctate or nearly smooth; pubescence fine.
  Thorax not wider in front, anterior angles obtuse; elytral punctures distinct. *pulchellus.*
  Thorax distinctly wider in front, anterior angles truncate; elytral punctuation almost entirely obliterated; testaceous, each elytron with a transverse piceous spot at middle of the side margin. *acutus.*

Specimens of *pulchellus* have been collected in Arizona and at Los Angeles (Coquillett).

SCIRTES HUMERALIS n. sp.

Oval, slightly oblong, piceous, moderately shining, head and thorax rufescent, a reddish band along the side margin from the humerus one-third to apex, each elytron with an indefinite paler area at apex, surface sparsely fulvo-pubescent. Antennæ testaceous, gradually darker to tip. Head rufescent, sparsely punctate, occipital region narrowly piceous. Thorax sparsely punctate. Scutellum rufescent, piceous at middle, punctate. Elytra slightly more coarsely punctate than the thorax. Body with few scattered punctures. Elytra as long as the body, scabrous, sparsely pubescent. Length, .10 inch; 2.5 mm.

Male. Last ventral large parallel, curved upward, channeled its entire length, acutely notched at tip. Last dorsal oval without processes. Pl. xx, fig. 2.

Allied most closely to *curvatus* Lec., but differs in the male characters, its color and by the shorter third joint of the antennæ.

One specimen. San José del Cabo.

MASTINOCERUS OPACULUS n. sp.

Slender, luteous yellow, abdomen piceous the last two segments yellow, surface very sparsely pubescent. Head scabro-punctate, but indistinctly. Thorax similar in form to that of *texanus* but less arcuately produced at apex, surface opaque very finely granular, with sparsely placed indistinct punctures. Elytra opaque, the disc very flat, surface minutely scabrous. Venter shining, sparsely punctate and pubescent. Length, .18 inch; 4.5 mm.

Closely resembles *texanus* but is much smaller, the dorsum more flat and the surface opaque without very decided sculpture.

Arizona, southern, but locality unknown.

Mr. Gorham (Biol. Cent. Am., iii, pt. 2, p. 106) seems to have the opinion that our species are not congeneric with the Chilian form described by Solier. The antennæ of the latter are said to have the eleventh joint biramose. While it is possible that such a character may be found, all instances heretofore mentioned have been found erroneous on second examination. Mr. Gorham admits that Cenophengus is related to Mastinocerus, because the second and third joints of the antennæ are short and without rami. This is equally true of both the Mastinocerus of our fauna.

The most remarkable opinion of Mr. Gorham is the placing of these genera together with Pterotus (which he does not know) in the Lymexylonidæ. To carry the idea to its legitimate extent, Phengodes, Zarhipis and Tytthonyx must also take the same course.

TELEGEUSIS n. g.

Facies of a Malthinus, slender depressed. Head oval, abruptly prolonged in front of the eye in a short muzzle, the clypeal region abruptly deflexed but not distinctly separated from the front, behind the eyes the head is feebly arcuately narrowed. Eyes prominent, finely granulated, distant from the thorax. Antennæ in front of the eyes inserted in the angle of the muzzle formed by the deflexed clypeus, eleven jointed *(female)* first joint stout, conical, longer than the next two together, second joint short, stout, shorter than the third, fourth longer than third, five to ten very slightly shorter, eleventh longer and fusiform. Labrum short and broad, anterior edge bisinuate. Mandibles falciform but not prominent, acute at tip. Mentum small, pentagonal. Labial palpi three, maxillary palpi four-jointed, the basal long as the next two, fourth scarcely bilobed. Claws simple. Body with well developed under-wings.

TELEGEUSIS DEBILIS n. sp.

Form slender, resembling Mathinus, testaceo-piceous, moderately shining, sparsely clothed with short semi-erect yellowish hairs. Head sparsely indistinctly punctate. Thorax quadrate with obtuse angles, apex truncate, base arcuate, sides slightly sinuate at middle, disc feebly convex with scarcely evident sparse punctuation, in each angle a distinct depression. Elytra half the length of abdomen, broader at base than the thorax, humeri rounded, surface sparsely punctate becoming gradually granulate and at apex densely granulate. Abdomen above sparsely punctate, the three basal segments almost entirely smooth, beneath more closely punctate. Legs and coxæ yellowish. Length, .22 inch; 5.5 mm. Pl. xx, fig. 1.

In this genus we doubtless have our first representative of the tribe Drilini. It is, however, remarkable in the length of the terminal joint of the palpi, nothing at all approaching it is known to me in the entire order of Coleoptera. The insect seems most nearly allied to Drilus, but in the absence of the male nothing positive can be asserted.

Sierra San Lazaro.

ATTALUS SETOSUS Horn, Proc. Cal. Acad. Sci., iv, p. 381.

This species was described from an unusually pale colored specimen. Others recently received show that the color may be entirely piceous, faintly bronzed. Others have simply a pale humeral spot, which extends and widens, covering nearly the entire elytral surface, except narrow sutural and marginal piceous stripes. It is easily known, however, in all its varieties by the short erect setæ.

In addition to San José del Cabo, it occurs at Miraflores, Sierra El Chinche, Santo Domingo del Taste and Sierra San Lazaro.

OCHODÆUS PENINSULARIS n. sp.

Oval, slightly oblong, fulvo-testaceous, sparsely clothed with short fulvous hair. Antennæ, except the first two points, piceous. Head very coarsely punctate, occiput slightly piceous, clypeus oval at middle, slightly sinuate each side, the margin narrowly reflexed, front not tuberculate. Thorax fully twice as wide as long, disc convex, not closely granulate, a vague median depression posteriorly. Elytra about one-fourth longer than broad, the striæ feebly impressed, moderately coarsely and closely punctate, intervals flat, very irregularly biseriately punctate. Length, .16–.22 inch.; 4–5.5 mm.

The mentum is a little longer than wide, deeply impressed its whole length and emarginate in front.

In the six specimens examined, in which both sexes are undoubtedly represented, I find no armature either of the femora or tibiæ. The male hind tibiæ are, however, somewhat shorter and more hairy. This species is most densely tuberculate, a vague median impression posteriorly. Elytra vaguely striate, punctures of striæ coarse but not close, intervals flat, more closely and finely granulate than the thorax. Length, .18 inch.; 4.5 mm.

Mentum broader than long, deeply concave, the apex emarginate.

The unique before me is a female, and shows no armature of the legs.

This species, by the form of mentum and simple clypeus, is not especially related to any in our fauna. In its color it is unique, and might be mistaken for an Onthophagus.

Pomona, Cal., from H. C. Fall.

OCHODÆUS FRONTALIS Lec.

This occurs in Coahuila, Mex. It evidently escaped Mr. Bates' observation, unless O—4 (Lamellic. p. 107) is it.

RHOPALOPHORA BICINCTA n. sp.

Black, rather dull, elytra with a basal and a post-median slightly arcuate narrow band of silvery white pubescence. Head closely punctate, occiput between the eyes smoother. Antennæ *(female)* yellow, not longer than the body, joints 5–10, gradually shorter, 11 slightly longer than 10, joints 8–10 slightly serrate. Thorax as in *R. longipes*, sparsely punctate, more closely on the flanks, surface alutaceous, beneath more shining, slightly transversely wrinkled and sparsely punctate. Elytra parallel, scarcely wider than the thorax, apices obtuse 3 or 4 dentate, surface closely cribrate punctate. Body beneath black, shining, sparsely punctate and with sparse hairs, but with denser patches of silvery white pubescence at the sides of mesosternum, the hind angles of metasternum and at the sides of the first ventral segment along the suture. Legs piceo-testaceous, the tibiæ paler, the femora at base darker. Length .20 inch.; 5 mm.

This species is placed temporarily in the genus from its very close resemblance in all the more important structural details, although the antennæ suggest a relationship with the Cleomenides, as defined by Lacordaire. The antennæ are not setaceous as in Rhopalophora, but rather filiform, the three penultimate joints slightly flattened and subseviate.

The specimen at my disposal is a female and unique, from which the useful parts of the mouth have disappeared. The ornamentation of the elytra is not in line with Rhopalophorus, and it seems very probable that the discovery of the male will show the necessity for suggesting a new generic name.

One specimen. San José del Cabo.

DYSPHAGA DEBILIS n. sp.

Slender, elongate, pale yellowish testaceous, abdomen piceous. Front not punctate, neck obsoletely punctate. Thorax a little wider at middle than long, sides slightly arcuate, surface dull, not distinctly punctate,

Head and thorax piceous black.
  Thorax distinctly punctate; elytra not costulate. *tenuipes.*
  Thorax smoother bicallous at base. *lævis.*
Head and thorax reddish yellow; elytra piceous and distinctly bicostulate. *bicolor.*
Pale yellowish testaceous, elytra bicostulate. *debilis.*

METACOLASPIS n. g.

Head oval, not deeply inserted, eyes free, entire, not very convex, oval, finely granulated; front feebly sculptured, clypeus not distinctly separated, labrum short, transverse. Last joint of maxillary palpi slender, attenuate at tip, longer than the preceding joint. Antennæ slender, three-fourths the length of body, first joint thickened, second one shorter than the third, joints 3–11 gradually slightly longer. Prothorax transverse, the front angles not dentiform, hind angles very obtuse, lateral margin entire. Scutellum oval obtuse at apex. Elytra very irregularly substriately punctate. Prosternum between the coxæ twice as long as wide. Legs moderate in length, femora slightly fusiform, the tibiæ slender, the four posterior feebly emarginate at outer angle of the tip. Tarsi moderate in length, claws deeply bifid, the inner division long and slender.

The insect for which the above generic name is proposed has the general aspect of *Colaspis brunnea* except the color. It is certainly allied to Metachroma by the structure of the prothoracic episterna, the bifid claws and the emarginate tibiæ.

From Metachroma it differs in having the second antennal joint much shorter than the third. The other two genera are from Malacca and the Philippine Islands. Pyropida has a broad prosternum and less deeply bifid claws, Chrysopida has dentate femora.

METACOLASPIS CONSPERSA n. sp.

Form moderately robust, general color pale yellowish-white, antennæ, metapectus, tibiæ and tarsi piceous; elytra brown with numerous yellowish-white spots usually small, irregularly placed, surface glabrous. Head smooth. Thorax one-half wider than long, sides feebly arcuate, front angles distinct, hind angles obtuse, surface polished with numerous moderately coarse punctures at the sides. Scutellum smooth. Elytra wider at base than the thorax, about one-third longer than wide, sides feebly arcuate, disc convex with closely placed deep punctures, substriately arranged with three faintly indicated costæ. Body beneath smooth, sides of metapectus finely punctate and pubescent. Length, .16 inch; 4 mm.

San José del Cabo.

COLASPIS MŒSTA n. sp.

Form robust, piceous, upper surface feebly dark-bronzed, moderately shining. Antennæ piceous, the basal five joints gradually paler. Head punctate, less closely on the occiput. Thorax twice as wide as long, narrower

BLEPHARIDA ATRIPENNIS n. sp.

Form moderately robust, rufo-testaceous, antennæ, elytra, tibiæ and tarsi piceous black. Basal joint of antennæ testaceous in front. Head smooth. Thorax fully twice as wide as long, slightly narrowed in front, front angle slightly nodiform, hind angle obtuse, disc convex, smooth, sparsely finely punctate. Scutellum smooth, rufo-testaceous. Elytra slightly wider than the thorax, oval, one-third longer than wide, convex, surface dull, very finely alutaceous, irregularly geminately striato-punctate, the punctures not coarse nor close. Body beneath sparsely punctate, slightly pubescent on abdomen and sides of metapectus. Length, .22 inch; 5.5 mm.

While the species is placed in Blepharida as a matter of expediency, there does not seem to be any valid character for its separation from that genus. The only other species at present in hand is our *rhois*, which differs in some characters from those given by Chapuis. The elytral sculpture differs notably from that of *rhois*, but several Mexican species resemble it in this respect.

San José del Cabo.

CREPIDODERA PENINSULARIS n. sp.

Oval, moderately robust, rufo-testaceous, elytra piceo-rufous with distinctly æneous surface. Head smooth, antennæ darker at tip. Thorax twice as wide as long, slightly narrowed in front, anterior angles truncate, hind angles acute, sides moderately arcuate, disc convex, with few coarse irregularly placed punctures, transverse impression moderately deep and with punctures. Elytra wider at base than the thorax, humeri obtuse, surface with rows of coarse and deep but not very closely placed punctures, intervals not convex, smooth. Body beneath smooth, abdomen indistinctly punctate and alutaceous. Legs paler. Length, .10 inch; 2.5 mm.

This species is not particularly related to any in the Boreal fauna, but is probably nearer *chiriquensis*, although from description abundantly distinct.

One specimen. San José del Cabo.

LUPERODES HISTRIO n. sp.

Form oblong, color variable above, beneath yellowish, metapectus piceous. Antennæ rather longer than half the body, testaceous, the apex and front edge of each joint piceous. Head smooth, blue or green, the front yellow. Thorax slightly wider than long, not narrowed in front, sides slightly arcuate anteriorly, a feeble sinuation posteriorly, hind angles acute, the anterior slightly nodiform, disc moderately convex, scarcely perceptibly punctulate. Elytra wider than the thorax, twice as long as wide, sides nearly parallel, disc moderately convex, sparsely regularly, finely punctate. Body beneath yellow, sides of metapectus piceous, surface sparsely punctate with short hairs. Femora yellow, with upper edge and apex piceous, tibiæ and tarsi piceous. Length, .16–.22 inch; 4–5.5 mm.

This insect is very variable in color.

sis of Galerucini of Boreal America (Trans. Am. Ent. Soc. 1893, p. 108). It is, however, quite certain that some other use or arrangement of characters must be adopted for the genera of the group Luperites as defined by Chapuis.

Sierra San Lazaro, Sierra El Chinche.

SCELOLYPERUS CYANELLUS n. sp.

Form elongate, piceous black, moderately shining, elytra violaceous, blue or bluish-green. Head smooth. Thorax quadrate, very little longer than wide, sides very feebly arcuate, anterior angles slightly nodiform, hind angles sharply rectangular, disc moderately convex, smooth. Elytra one-half wider than the thorax, twice as wide as long, disc moderately convex, sparsely punctulate. Body beneath piceous or blue-black, sparsely punctulate and pubescent. Legs black, femora bluish, alutaceous, the anterior and middle coxæ and all the trochanters yellow. Length, .12-.16 inch; 3-4 mm.

The males have the posterior tibiæ straight. Variations occur which seem to be merely due to immaturity—the antennæ may be brownish-yellow and the under side of prothorax, tibiæ and tarsi yellowish-testaceous.

This species resembles a diminutive form of that variety of *maculicollis* with black thorax.

El Taste and San José del Cabo.

TRIPHALUS CRIBRICOLLIS n. sp.

Piceous black, feebly shining. Head moderately coarsely and closely punctate with a slight tendency to become strigose; mandibles more densely and finely punctate. Thorax quadrate, slightly broader than long and slightly narrower in front, sides very slightly arcuate, base arcuate, disc convex coarsely and closely punctate, each puncture (as on the head) bearing a short yellow hair. Elytra regularly oval, broadest at middle, one-half longer than wide, base not wider than base of thorax, disc convex with the striæ of coarse punctures not closely placed, intervals slightly convex and with two series of finer punctures irregularly placed each bearing a short yellow hair. Body beneath more shining than above, coarsely but not closely punctate. Length, .22 inch; 5.5 mm.

Similar in form to *perforatus*, but with the striæ of the elytra more closely and the thorax more densely punctured. The finer punctures of the intervals in *perforatus* are scarcely evident and the hairs very short.

One specimen. Miraflores.

CERENOPUS ANGUSTATUS Horn. Proc. Cal. Acad. Sci. 1894, p. 426.

A recent invoice with a dozen specimens shows that my description of the female was erroneous. The female at hand was merely a feeble specimen of *concolor*.

The female of *angustatus* has the clypeus very different from the male, which may be described as truncate with an abrupt median notch either oval or subtriangular.

Tarsi black with a ring of whitish pubescence at the base of each joint. Length, .40 inch; 10 mm.

Male. Antennæ setaceous the first joint as long as the next two, not sinuate at apex, second three-fourths as long and equal to the next three joints together. Anterior tibiæ with two terminal spurs, the first joint of tarsi longer than the second. Last ventral segment incised.

This species resembles *linearis* very closely and it is probable that the females will be difficult to separate.

San José del Cabo.

At the time of my study of Macrobasis (Proc. Amer. Philos. Soc. 1873) the male of *linearis* was unknown. The following are the sexual characters which will separate it from *languida:*

M. linearis ♂ Lec. Antennæ setaceous, the first joint as long as the next five not sinuate at tip, second joint scarcely a third of the first. Anterior tibiæ with a single spur, first joint of tarsi much shorter than the second and strongly compressed at base.

OTIDOCEPHALUS ALTERNATUS n. sp.

Form of *vittatus*, piceous black, shining, clothed with recumbent and not dense gray hairs the alternate intervals of the elytra naked, without erect setæ. Rostrum smooth in front, not carinate, punctate at the sides. Thorax elongate oval, one-half longer than wide, equally narrowed at apex and base, regularly convex, coarsely not closely punctate. Scutellum densely clothed with white pubescence. Elytra elongate oval, widest at middle, humeri well marked. Punctures in striæ rather coarse and closely placed, intervals slightly convex, intervals 2–4–6–8 moderately densely pubescent, the others sparsely biseriately punctate, each puncture with a hair. Body beneath sparsely hairy, a denser line at the sides of meso- and metapectus. Legs brownish, sparsely punctate and hairy. The femora with a small tooth. Length, sine rost., .18 inch; 4.5 mm.

Related to *vittatus* and with similar vestiture but less dense, the hairs are simple and not tufted. It differs also in the absence of smooth thoracic line and is without erect setæ.

One specimen. La Paz.

OTIDOCEPHALUS SPARSUS n. sp.

Form of *scrobicollis*, piceous black shining, surface clothed with tufted pubescence not closely placed, thorax and elytra with erect white hairs. Rostrum coarsely punctate, smooth at middle in front. Thorax slightly oval, equally narrowed at apex and base, one-half longer than wide, sides feebly arcuate, disc convex, very coarsely and deeply, moderately closely punctate, tufted hairs not closely placed, erect hairs directed toward the front. Elytra oblong oval, widest slightly behind the middle, humeri distinct, surface with striæ of moderately coarse punctures, not deep nor closely placed, intervals flat sparsely punctate. Body beneath sparsely clothed with tufted hairs and erect setæ. Legs piceous, tarsi pale. Femora of middle, base and apex equal, disc convex, very coarsely deeply and moderately closely punctate, the median line carinate from base two-thirds to apex. Elytra oval, widest slightly behind the middle, humeri distinct, disc with disdinctly impressed striæ having coarse, deeply impressed and rather closely placed punctures, intervals flat. Body beneath clothed with much finer pubescence than the upper surface. Tibiæ and the femora at base rufescent. Femora with a small tooth. Claws with quadrangular tooth at base. Length, .21 inch; 5.25 mm.

This species viewed in profile is more convex than any of our hairy species, resembling in this respect *Chevrolati*. The vestiture of the upper surface is rather formed of very large narrow scales than simple hairs. They are however not at all tufted as in *sparsus* or *Ulkei*. The carinate thorax will at once separate it from any of our species.

Occurs in Texas. One specimen was given me by Dr. Dohrn as from California, but I believe the locality erroneous.

In the Annals of the N. Y. Acad. Sc., 1892, Capt. Casey reviews the species of Otidocephalus describing several new ones. *O. nivosus* from intermediate specimens from Utah does not seem specifically separable from *vittatus*.

O. cavirostris should be compared with *Poeyi*, the inflated and excavated beak on which so much stress is laid is purely a sexual character. (See Lac. Genera, vi, p. 569, note, also Schoenh. Curcul. vii, 2, p. 208. Neither author, however, recognizes that it is a male character.)

O. perforatus Horn. has been separated as a distinct genus, *Oopterinus*, based on the absence of scutellum. The genus is not valid, as a distinct scutellum exists although less evident than in the species with distinct humeri.

Copturus sobrinus n. sp.

Piceous, elytra, legs and beak castaneous. Rostrum and sides of head with broad white scales, eyes contiguous on the front. Thorax a little broader at base than long, slightly narrower in front, feebly constricted at apex, sides feebly arcuate, disc slightly convex, coarsely, deeply and closely punctate, at sides with broad white scales, at middle a short line from the base with narrower scales. Elytra deeply striate with elongate punctures, intervals subcostiform and imbricately sculptured, color castaneous ornamented with short lines of white scales on the intervals forming in a general way a basal band, a humeral lunule extending inward at middle, a white area on the suture near the apex, another at sides near apex, the scales otherwise are brownish. Body beneath and legs densely clothed with white scales, broad on the body, narrow on the legs. Length, .08 inch; 2 mm.

Closely related to *minutus* in color, form and markings, but it is readily known by the form of elytral intervals. In *minutus* the intervals are flat and decidedly wider than the striæ, the intervals of *sobrinus* are subcostiform and erately coarsely, deeply and closely punctate, with faintly indicated median carina. Elytra wider at base than the thorax, disc not depressed, striæ with deep quadrate punctures, intervals flat, the third and fifth finely carinate, rather roughly punctate. Body beneath coarsely, closely and equally punctate. Femora not toothed, tibiæ serrate. Length, .18-.22 inch.; 4.5-5.5 mm.

Allied in its vestiture to *serripes*, but in form to *irrorata*. Is much less robust and with less coarsely toothed tibiæ than the first, and differs from the second in vestiture and the absence of femoral tooth.

Two specimens. Arizona, Sierra San Lazaro.

CONOTRACHELUS LUCANUS n. sp.

Oblong oval, similar in form to *naso*, piceous, dull, elytra marmorate with brownish and dirty white hairs, the latter more evident at the sides and with four more conspicuous white spots at the base of the third and sixth intervals. Antennæ rufescent, inserted less than a third from the tip of the rostrum, which is rather deeply trisulcate on each side, the sulci coarsely punctured, surface glabrous, a few hairs near the base. Head densely punctate, with fulvous hairs. Thorax quadrate, a little wider than long, abruptly constricted in front, sides feebly arcuate, disc convex, very coarsely cribrate, with a median carina from apex, not quite reaching the base, surface with sparse erect hairs. Elytra more than half wider at base than the thorax, humeri not acute, disc with striæ of quadrate punctures not densely placed, the intervals 3-5-7-9 finely carinate, and with a row of short erect hairs. Body beneath very coarsely and deeply punctate. Mesosternum protuberant. Femora unidentate, claws divergent and acutely toothed. Length, .20 inch.; 5 mm.

This species belongs to the group defined by Dr.

LeConte as 1—B (Rhynchophora, p. 239), and by the moderate length of beak, which is strongly striate, and by the protuberant mesosternum, is allied to *posticatus.* It resembles the latter species in the vestiture, and differs especially in the very coarse sculpture of the thorax, which approaches that of *cribricollis.*

One specimen. San José del Cabo.

CONOTRACHELUS ECHINATUS n. sp.

Form of *erinaceus*, piceous, clothed with luteous and dark brown scales, indiscriminately intermixed on the thorax, on the elytra at declivity an indefinite band of the paler color, on the intervals are moderately long black hairs, in the punctures of the striæ a slender pale hair. Beak longer than head and thorax, sulcate at the sides, in front rather densely scaly and with erect hairs, antennæ inserted close to the tip. Thorax wider than long, not greatly constricted in front, sides feebly arcuate, disc convex, coarsely, deeply and not closely punctate. Elytra nearly twice as wide at base as the thorax, one-third longer than wide, humeri prominent but not dentiform, disc striate, striæ punctate, intervals flat. Abdomen coarsely and

EXPLANATION OF PLATE XX.

Fig. 1. Telegeusis debilis *Horn*, greatly enlarged.
Fig. 2. Malthodes lucanus *Horn*, terminal ventral segments of male, underneath view.
Fig. 3. Malthodes lucanus *Horn*, terminal ventral segments of male, lateral view.
Fig. 4. Head of male Cerenopus angustatus *Horn*.
Fig. 5. Head of female of same.
Fig. 6. Anisotoma valida *Horn*, hind leg of male.
Fig. 7. Anisotoma Merkeliana *Horn*, hind leg of male.
Fig. 8. Zalobius spinicollis *Lec*.
Fig. 9. Zalobius serricollis *Lec*.
Fig. 10. Asemobius cælatus *Horn*.

THIRD REPORT ON SOME MEXICAN HYMENOPTERA, PRINCIPALLY FROM LOWER CALIFORNIA.

BY WILLIAM J. FOX.

[With Plate xxi.]

The present paper is based on collections made in the fall of 1894, by Messrs. Eisen and Vaslit. By far the greater portion was gathered at San José del Cabo in September, and contains a number of species not mentioned in my former paper. The remainder, from the vicinity of Tepic, in the Territory of Tepic, on the Pacific Coast of Mexico, is of interest as it demonstrates the difference of the fauna of the main land from that of the peninsula, as the species are in nearly every case different from those of the latter region. The ants and parasitic hymenoptera are not included herein, but will form the subjects of other papers by Messrs. Pergande and Ashmead respectively.

CHRYSIDIDÆ.

CHRYSIS SELENIA Costa. Numerous specimens. San José del Cabo.

MUTILLIDÆ.

SPHÆROPHTHALMA MAGNA Cress. San José del Cabo. Thirteen specimens.

SPHÆROPHTHALMA GLORIOSA Sauss. San José del Cabo. Fifteen specimens. The ground color of this species varies considerably; usually entirely red, yet forms occur with it entirely black, but forms intermediate are commoner. The color of the unusually long, white pubescence with which the species is clothed is invariable. The size varies from 8–17 mm.

SPHÆROPHTHALMA XALAPA Bl. San José del Cabo. One specimen.

SCOLIIDÆ.

MYZINE HAMATA Say. Three females. San José del Cabo and Tepic. The markings of the abdomen show considerably variation in this species. The form occuring in the eastern United States usually has the third and fourth dorsal segments, in the ♀, banded with yellow; in the two specimens from San José these bands are interrupted medially, but are more prolonged than the lateral spots on the other segments; in the Tepic specimen the third segment only is banded.

MYZINE HYALINA Cress. One ♂. San José del Cabo.

MYZINE SEXCINCTA Fabr. What I take to be a variety of this species is represented in the collection by a single ♀ from Tepic. Dorsal abdominal segments 1–4 are each marked by a broad yellow band; the coxæ, trochanters and basal two-thirds of the femora black; flagellum blackish. I considered this specimen at first as representing a new species, but the absence of substantial structural characters together with the fact that forms, more or less intermediate with the typical one, occur in the United States, led me to consider it but a variety.

ENGYCYSTIS* gen. nov.

Plate xxi, fig. 1, female; fig. 2, head from front; fig. 3, abdomen of ♂; fig. 4, hind leg of ♀; fig. 5, fore leg of same.

Form elongate, *slender in both sexes.* Eyes tolerably large, reaching the base of mandibles, *not emarginate in either sex.* Mandibles *armed internally with a strong tooth between middle and apex.* Ocelli distinct. Insertions of antennæ protected by a prominent lobe, the distance between the insertions less than that between them and the eye margin. Antennæ rather long and slender, tapering to apex, in length about equal to the thorax, joints long and easily distinguished, 12 in ♀, 13 in ♂. *Maxillary palpi* 5-, *labial palpi* 4-*jointed*, the joints of the former unusually *long and slender*, of the later short and stout. Thorax elongate-oblong, narrower than head. Pronotum much longer than dorsulum and shorter than middle-segment, the dorsulum small, if anything, shorter than scutellum, the latter somewhat narrowed posteriorly and longer than broad. Mesopleuræ *ridged anteriorly, and beneath separated from the mesosterum by an indis-*

with a well developed pygidial area *which is smooth and bounded laterally by a sharp ridge*, in the ♂ this segment is emarginate at apex into which the huge, curved spine fits, which extends up from beneath. Wings ample, *the stigma large, lanceolate*, at least half the length of the marginal cell; *the latter lanceolate, firmly united to the costal margin its entire length.* Three distinct submarginals and an indication of a fourth, *the second shorter than either the first or third.* Recurrent nervures received by the second and third submarginals. *Basal vein confluent with the transverso-medial nervure in both sexes.* Cubital vein of hind wings originating a little *before* the apex of the submedian cell *in both sexes*, rarely confluent with the transverso-medial nervure.

Type, *E. rufiventris.* This genus is allied to *Myzine*, but is very distinct, as will be seen by the characters given above. It is erected for *Myzine rufiventris* Cress., and it is surprising that observers like Cresson and Cameron (Biol. Centr. Amer. Hym., ii, p. 258) should have overlooked such prominent generic characters as this species possesses. Moreover, the coloration—head, thorax and first abdominal segment black, with the remainder of abdomen bright red, is strikingly different from any of the species of *Myzine* that I am aware of.

The ♀ which has not before been noticed, is very similar to the ♂ ; the head is much more sparsely punctured, and the thorax in general more coarsely sculptured, except the mesopleuræ, which are very densely punctured, while in the ♂ they have the punctures large and well separated; abdomen above almost impunctate, else the strong scattered punctures evident in the ♂ are very feeble; wings in the middle and at base hyaline, otherwise fuscous, so that they appear bifasciate, hind pair except apex hyaline; first and second joints of flagellum about equal in length; in the ♂ the first is shorter than the second; colored alike in both sexes.

Two ♀ specimens. San José del Cabo. I am indebted to Mr. Samuel Henshaw for the loan of Cresson's type, which is a ♂.

In my opinion this genus differs sufficiently from the rest of the Scoliidæ, particularly *Tiphia* and *Myzine*, to be constituted a tribe of that family.

SCOLIA BADIA Sauss. San José del Cabo. One ♀.

SCOLIA GUTTATA Burm. Two specimens, ♀ ♂. Tepic. Thoracic markings in these specimens are entirely absent. The only pale color to be found on them exists on the second and third dorsal abdominal segments in the shape of a large spot on each side.

ELIS DORSATA Fabr. San José del Cabo and Tepic.

ELIS TRICINCTA Fabr. Two specimens. Tepic.

ELIS TRIFASCIATA Fabr. One ♀. Tepic.

ELIS PLUMIPES Dr. San José del Cabo. Numerous ♂ specimens. These differ from the more northern specimens by the clypeus being spotted on either side, as in

POMPILUS TENEBROSUS Cress. One ♀. San José del Cabo.

POMPILUS FULGIDUS Cress. One ♀. San José del Cabo. This specimen is smaller and less blue than the typical form, but otherwise agrees with it.

POMPILUS CORRUSCUS var. **JUXTA** Cress. San José del Cabo.

POMPILUS INTERRUPTUS Say. A variety of this species from San José del Cabo.

PRIOCNEMIS FLAMMIPENNIS Sm. Tepic. One female.

AGENIA MEXICANA Cress. Tepic. One female.

PEPSIS RUBRA Dr. Two females, one male. San José del Cabo.

PEPSIS TERMINATA Dhlb. One ♂ from San José del Cabo.

SPHEGIDÆ.

SCELIPHRON LUCÆ Sauss. Three specimens of this handsome species. San José del Cabo.

SCELIPHRON HISTRIO St. Farg. Tepic. One specimen.

SCELIPHRON *(Chalybion)* **CÆRULEUM** Linné. Twelve males. San José del Cabo.

SCELIPHRON *(Chalybion)* **ZIMMERMANNII** Dhlb. Five females. San José del Cabo. *Sc. aztecum* Sauss is probably the ♂ of this species.

SPHEX HABENA Say. One specimen. San José del Cabo.

SPHEX FLAVIPES Sm. Tepic. Two females. This is the form described by Saussure as *hirsutus*.

SPHEX ABDOMINALIS Cress. San José del Cabo. One ♀.

SPHEX THOMÆ Fabr. Tepic and San José del Cabo. Two females.

AMMOPHILA MICANS Cam. One ♀. Tepic.

AMMOPHILA ZANTHOPTERA Cam. Tepic. One female. Seems to be close to *mediata* Cress.

AMMOPHILA FEMUR-RUBRA Fox. San José del Cabo. One specimen.

AMMOPHILA PICTIPENNIS Walsh. Three females. San José del Cabo. These differ only from more northern specimens in their smaller size.

AMMOPHILA YARROWI Cress. Eight specimens. San José del Cabo.

CERCERIS GRAPHICA Sm.

I am not acquainted with the female of this species, the sex described by Smith. A ♂ specimen from Tepic agrees so well with Smith's description that I refer it to *graphica* without hesitancy. The flagellum is reddish beneath to the apex and above, at base the scape being entirely of that color; clypeus entirely, sides of face broadly, yel-

Bembex monodonta Say. Four males. San José del Cabo.

Trypoxylon albitarse Fabr. Tepic. One female.

Trypxoylon aztecum Sauss. San José del Cabo. Five ♀ and thirteen ♂ specimens. In the ♂ the color of the first tarsal joint varies from white to black. The reddish color existing on the basal joints of flagellum beneath in the ♂ does not occur in the female.

Trypoxylon spinosum Cam. Two specimens. Tepic and San José del Cabo.

Trypoxylon centrale n. sp.

♀.—Head higher than broad, finely and closely punctured; fore ocellus separated from the posteriors by a slightly greater distance than the latter are from each other, a distinct space between the posteriors and each eye; front just above the antennæ with a prominent, longitudinal ridge or carina, which extends less than half way to the fore ocellus; face depressed on each side of this ridge, above it the front convex, parted by a not strong impressed line running from the ridge to fore ocellus; occipital notch indistinct; clypeus flat, not carinated, its anterior margin rounded out, subangular in the middle; space between eyes at the vertex greater than the combined length of antennal joints 2 and 3, at the base of clypeus this space is about one-third less than at the vertex; first joint of flagellum about one-third longer than the second; pronotum strongly and bluntly shouldered at each side; dorsulum finely and very closely punctured, the scutellum less so and not impressed; mesopleuræ less closely punctured than the dorsulum; middle segment above distinctly striated, obliquely and transversely, with a slight, rather indistinct medial impression, posterior face with the sculpture hidden by dense, pale pubescence, strongly furrowed down the middle, however, sides shining, delicately striato-punctate; abdomen long and slender, first segment subnodose at apex, fully one-third longer than the second, second and third segments united about one-quarter longer than the first. Black; mandibles, darker apically, greater part of fore tibiæ, their tarsi and a ring at base of middle tibiæ, not always present, however, reddish-yellow, sides of the second, third and fourth abdominal segments basally reddish; tegulæ pale testaceous; calcaria whitish; wings hyaline throughout, iridescent, nervures and stigma black, space between the recurrent nervure and the transverso-cubital nervure on the cubital vein distinctly greater than the width of the submarginal cell at apex; clypeus, head in front, including the eye-emarginations, cheeks, and thorax beneath less densely, with silvery pubescence. Length, 9 mm.

San José del Cabo. Two specimens. Distinct by the longitudinal ridge of front, sculpture of middle segment above, clear wings, shape of clypeus, coloration, and position of ocelli, which are not connected by a furrow.

VESPIDÆ.

POLISTES FUSCATUS Fabr. Ten specimens. Tepic.

POLISTES CARNIFEX Fabr. Ten specimens. Tepic. All very large.

POLISTES BELLICOSUS Cress. Ten specimens of a form which I consider a variety of this species, differing from Texan individuals by the scutellum and metanotum (postscutellum) being entirely yellow, and the markings in general, particularly those of the abdomen, more extended; the middle segment lacks the parallel yellow lines which occur in the Texan form. The specimens are from San José del Cabo.

POLISTES MINOR Pal. Bve. San José del Cabo. Three specimens.

POLISTES LINEATUS Fabr. Numerous specimens. San José del Cabo.

POLYBIA DECEPTA n. sp.

Entirely of a very dark, almost blackish brown, except the mandibles, which are ferruginous, and the antennæ, which are black, clothed with a sericeous pile; wings: basal two-thirds or more of anteriors black, as are also the nervures, on the remainder whitish, the nervures yellowish, posteriors blackish throughout; middle-segment with a deep, convex, depression, extending from base to apex; hind coxæ very large; medial and hind tarsi with joints 3 and 4 greatly extended at apex within, particularly the fourth joint; petiole of abdomen robust, most convex in middle above, before the apex with a transverse impression. Length, 15 mm.

One specimen, either a ♀ or ☿. Easily distinguished by the color of wings, which is exactly as in *Chartergus apicalis*, as in the rest of the insect. It evidently belongs to Saussure's Division Iota, and seems to come closest to *P. socialis* Sauss., from Brazil. Its similarity in color to *Chartergus apicalis* is really remarkable.

MISCHOCYTTARUS LABIATUS Sauss. Tepic. One specimen.

APIDÆ.

AGAPOSTEMON MELLIVENTRIS Cress. San José del Cabo. One ♀ specimen. Another unidentified species having the abdomen entirely black, is in the collection, from the same locality.

COLLETES sp. A specimen of a species related to *aethiops* Cress. Tepic.

CALLIOPSIS MEXICANA Cress. Tepic. One specimen.

PERDITA sp. One specimen. Tepic. Related to *8-maculatus* Say, from the United States.

ANTHIDIUM NOTATUM Latr. Two ♂ specimens from San José del Cabo, which represent a variety of this species, differing in the paler markings, entirely black femora, and by having greater part of tibiæ black; structurally there is apparently no difference from specimens with a fringe of long, golden hairs; antennæ black, the flagellum beneath fuscous, the apical joint beneath reddish testaceous; thorax black, its greater part clothed with dense, black pubescence, which gradually shades from hind part of dorsulum into the fulvous pubescence with which the middle segment is clothed; pubescence of mesopleuræ posteriorly colored as on the front; legs blackish brown, fore femora with black pubescence, that of medial femora a mixture of pale and black, while on the hind pair it is longest and fulvous, tibiæ and first joint of tarsi with short, dark hair on outer portion, internally reddish, apical tarsal joints reddish, with pubescence of a darker color; wings pale fulvo-hyaline, nervures and stigma black; abdomen above with the base of segments 2–4 and the fifth entirely bluish, the apical portion of segments 2–4 greenish, first segment and extreme sides with long fulvous pubescence, the fifth and sixth except base, with long black pubescence, the remaining dorsal segments clothed with short, thin, appressed, yellowish pubescence, which is most conspicuous on apical or greenish portion, beneath, the abdomen pale testaceous, the apical margins of the segments with a fringe of long, fulvous hair, which is, however, blackish medially on the fourth and fifth segments, the sixth ventral with black pubescence only. Length 18 mm.

Tepic. One specimen. Distinguished by the color of the thoracic pubescence and of antennæ. Related to *mexicana* Cress. by color of abdomen.

MEGACILISSA MEXICANA Cress. Tepic. One specimen.

XYLOCOPA FIMBRIATA Fabr. Tepic. Two specimens.

XYLOCOPA VARIPUNCTATA Patt. Ten ♀, one ♂, specimens. San José del Cabo.

CENTRIS FLAVIFRONS Fabr. Tepic. One specimen.

EULEMA FASCIATA St. Farg. One specimen. Tepic. Smith (Ann. Mag. N. H., (4) xiii, p. 442) unites *fasciata* and *cajennensis* under the latter name, notwithstanding that *fasciata* is the first described.

BOMBUS DILIGENS Sm. Tepic. One ☿.

BOMBUS sp. From Tepic are two ☿'s and one ♀ not structurally distinct from *B. medius* Cress., although the thorax lacks the broad black band so prominent in *medius*, and is entirely yellow above. It is probably but a variety of *medius*.

TRIGONA BIPARTITA St. Farg. One specimen. Tepic.

APIS MELLIFICA Linné. Numerous specimens, ♂ and ☿ from both localities.

THE NEOCENE STRATIGRAPHY OF THE SANTA CRUZ MOUNTAINS OF CALIFORNIA.

BY GEORGE H. ASHLEY.

[With Plates xxii-xxv.]

INTRODUCTION.

The following paper gives the results of a preliminary study of the Tertiary stratigraphy of the Santa Cruz Mountains, but such additional notes upon the earlier and later rocks are given as may be of value to subsequent observers.

The data from which the stratigraphic column herein given has been worked out were obtained chiefly in the cliffs along the sea coast, backed up by a reconnoissance of the mountains themselves. A large number of fossils were collected and determined, and a beginning was made upon a detailed geological map of the mountains, chart No. 3055 of the U. S. Coast and Geodetic Survey being used as a foundation.

To determine how far the conditions found in the Santa Cruz Mountains hold good in other parts of the Coast Ranges, short excursions were made into the Mount Hamilton Range, the Gavilan Range, and to a number of points in Los Angeles county.

Altogether about five months were spent in the field.

TOPOGRAPHY AND PHYSICAL GEOGRAPHY.

Santa Cruz Mountains—This name has been given to the series of parallel ridges extending from the Bay of Monterey northward to Point San Pedro. The ridges have a strike of nearly northwest and southeast. They reach their highest point in Mount Bache, 3780 feet above sea-level; further to the north Black Mountain reaches a height of nearly 3000 feet. Further to the northwest, and south of Pilarcitos Lake and Creek, the

Cumbre de las Auros rises in high bare ridges 2000 to 3000 feet high, and again near Point San Pedro this same ridge attains a height of 1940 feet in Mount Montara.

The ridge which starts in at Mussel Rock, north of Point San Pedro, reaches its highest point in Black Mountain, and to the southeast runs out gradually into the plain of Santa Clara Valley. The granite ridge which rises at Point San Pedro breaks down before reaching Pilarcitos Creek.

West of the high ridge, of which Mount Bache is a part, is a granite ridge running from near Santa Cruz nearly to Pescadero Creek. In this region considerable study would be required to systematize the ridges. The ridges and their narrow intervening valleys occupy a region about sixty-five miles long by twenty-five wide as a maximum. On the ocean side the mountains in some places reach the sea; in other places they are separated from the ocean by a narrow strip of flat land. From Lake Merced to Mussel Rock the foothills are cut by the ocean in bluffs from 200 to 700 feet in height. At Point San Pedro the prominent ridge, of which Mount Montara is cut by the ocean. Much of the distance from Point Montara to Lobetus, the Quaternary and underlying Miocene form low cliffs.

From Lobetus to Pescadero Creek the ocean cuts a number of ridges forming high bluffs, the Merced series being exposed, with a small amount of Quaternary overlying. From Pescadero Creek to Point New Year the flat land occupies a narrow belt from a few hundred feet to a half a mile broad. Between Point New Year and El Jarro Point the mountains are cut in high bluffs, the rock being the White Miocene Shale.

At El Jarro Point the level belt begins again and continues to the Bay of Monterey, broadening out at Santa Cruz, and extending up the valley of the Pajaro River as a broad plain. At Santa Cruz this horizontal land appears at four distinct levels, the lower two being very noticeable, the highest standing over 700 feet above sea-level.

The level land, which extends up the Pajaro River and Arroyo de las Llagas, cuts off the range from the Gavilan Range to the south and merges almost imperceptably into the broad level of the Santa Clara Valley. At San José the Santa Clara Valley has a breadth of about twelve miles, but to the north is largely occupied by San Francisco Bay, so that at San Carlos and to the north the foothills are close to the Bay.

From South San Francisco to Lake Merced, a low gap cuts off the Santa Cruz Mountains from the San Bruno Mountains and other hills in and about San Francisco.

The main axis of the range is indicated by the name "Santa Cruz Mountains" on the sketch-map. At present only the northern end of the range has been mapped topographically. But in general it may be said that the whole area, within the limits indicated above, is occupied by an irregular series of ridges and valleys, often with a difference of level of 1000 feet or more. These ridges are sometimes parallel to the main axis and structural in their nature, but more frequently have a trend away from the main axis at various angles and are the result of erosion.

The main topographic features of the northern half of the range are as follows: From the Seven-Mile Beach, between Mussel Rock and Lake Merced, a line of hills extends southeast to San Francisquito Creek, where there is a broad wind-gap. Beyond this they continue in the same direction until they run out in the Santa Clara Valley. This line of hills is also cut in several other places: by San Mateo Creek; by the creek which rising on the "Jersey Farm" flows down to the bay close to San Bruno station; and by a branch of Twelve-Mile Creek and several creeks to the south. Its general aspect is that of a block tilted up, having been faulted along its southwestern edge. It will be seen from the map that the drainage is all one way in this line of hills with the exceptions noted. Aside from the three streams mentioned, seen on the narrow divides or is broken down so as not to be recognizable. It will be noted too that the streams do not always run direct to the Bay, but frequently spread out in their headwaters at right angles to their general course, as though they had found strata which were more easily eroded than those further down. At two places, west of San Mateo and west of Redwood City, large outcrops of serpentine give to the top of the hill the flat aspect of a plateau, and from this rise abruptly high cone-shaped knolls of phthanite. Near Belmont and San Carlos this phthanite forms abrupt hills close to the salt marsh bordering the bay. These foothills are for the most part destitute of brush or trees, with smooth rounded surfaces and showing but few rock exposures.

The second topographic feature of importance is the long valley running from Mussel Rock to Black Mountain. This valley is occupied at the northern end by several small creeks and lakes; in the middle by San Andreas Lake and Creek, and Crystal Springs Lakes; and at the southern end by Bear Creek, and San Francisquito Creek.

On account of the difference in the erosion of the broad valley which San Francisquito Creek has cut in the foothills, and the narrow precipitous valley of San Mateo Creek, the present outlet, it has been suggested that the drainage of the whole valley was originally through the San Francisquito Creek. According to that view San Mateo Creek has been simply one of the backward cutting streams of the northeast slope, which has finally cut back far enough to tap the valley and claim a large share of its drainage. There are a number of other places where the same process is approaching similar results. Near Searsville the valley is quite broad and to the southeast forms the valley of San Francisquito Creek, finally ending in Coal Mine Cañon in the flank of the Black Mounain.

The next salient topographic feature is the main ridge of the mountains. This starts at Mussel Rock and follows the same general direction, nearly southeast. At its northern end it can hardly be distinguished topographically from the foothills previously described; but near San Andreas Lake, it reached a height of 1300 feet and is distinctly marked off by the valley just described. In width it extends here from the Crystal Springs Valley to Pilarcitos Valley. Its northwestern end is serrated by the San Pedro, Calera, Salt Lake, Milagra and other valleys into a number of long projecting points running down to or nearly to the shore. Near San Andreas Lake this main ridge is somewhat broken by San Mateo Creek, and, after being much reduced between San Mateo Creek and Pilarcitos Lake, rises and continues southeastwards with very even crest as far as the San Mateo-Spanish Town road. South of this road it becomes higher, with narrow, slightly uneven crest, until it swings around the head of the long valley described, and joins Black Mountain

PREVIOUS WRITERS.

The following will show in a general way the development of our present knowledge on the Coast Ranges, and the Santa Cruz Mountains in particular. Only the more important points are mentioned here, as these and other works will be referred to in detail in subsequent chapters.

Beechey.—In 1825 to 1828, Captain Beechey* made a voyage to the Pacific and Behring Straits. His notes and collections on the geology of the vicinity of San Francisco were worked up by Professor Buckland. A map is given of the headlands about the Golden Gate, upon which serpentine, sandstone and jasper rock are represented.

Tyson.—In 1849, Mr. P. T. Tyson† visited California. He notes the presence of sandstones containing a big oyster (*Ostrea titan*, Conrad) near Martinez and in Livermore Valley, and assigns the strata to Eocene or Miocene age. He finds strata which he thinks may be quite recent or late Tertiary. He describes quite accurately the cherts, jaspers, etc. (phthanites). He notes the presence of hypogene and metamorphic rocks of many kinds, which have been twisted about and mixed together in the most confused manner, and mentions having found in a small space near Bodega Point, gneiss, mica slate, indurated talcose slate, hornblende slate and serpentine, the last containing chromiferous iron. Near San Diego he notes the extensive diffusion of diluvial drift.

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* Zoology of Captain Beechey's Voyage to the Pacific and Behring's Straits in 1825–1828. London. 1839.

† Report of the Secretary of War, Communicating Information in Relation to the Geology and Topography of California. Senate, Ex. Doc. No. 47. 1850, pp. 15 *et seq.*

Trask.—Dr. John B. Trask*, as State Geologist, made a report in 1855, in which he defines the Coast Mountains, also the local name of Santa Cruz Range. He divides the rocks of the Coast Ranges into three groups: Tertiary, Primitive and Volcanic. The volcanic rocks he thinks to be late Miocene in age. His Primitive Group included the syenites, mica schist, granite, gneiss, porphyries and the older greenstone, including also the serpentine rocks; he also groups with these a crystalline limestone, quite common from Santa Cruz southward, and makes it the same in age as the group which extends through three hundred miles of the Sierra Nevada, noting that it is older than the igneous rocks. In the Tertiary he calls attention to the widespread existence of bituminous or Monterey shale, calling it, by way of distinction, the "infusorial group," and its age the "Infusorial Period," but he makes them horizontal, and their exposure due to simple uplift. Above this he places "sandstones and slates," the former predominating. These upper beds are very fossiliferous.

Dana.—In the report of the U. S. Exploring Expedi-

Navy Point, Benicia, and from San Francisco to the Pacific. He names and describes the San Francisco sandstone, abundant at San Francisco and elsewhere. He assigns it to the Tertiary, though a portion of the Upper Cretaceous may be represented. He describes alluvial deposits about San Francisco Bay, drift deposits in low passes in San Francisco and sand dunes in the same place. From finding "Post-Pliocene deposits" at Monterey, Santa Barbara, San Pedro and San Diego, he argues for a very recent uplift of that region.

Whitney.—During the survey under Prof. Whitney,* the Santa Cruz Mountains were crossed in several directions. His report in a very general way points out the distribution of the different formations in those mountains. He makes the metamorphic rocks and San Francisco sandstone Cretaceous, thinks certain shales in the valley near Searsville are Cretaceous, but assingns most of the later rocks of the mountains to the Miocene: He calls the strata between Lake Merced and Mussel Rock Pliocene, overlaid unconformably by post-Pliocene.

In 1880, in his "Contributions to American Geology," Whitney† calls attention to the fact that in the Coast Range the movement has produced crushing and breaking, rather than folding and uplifting. He notes Pliocene near San Diego, at north end of San Fernando Valley, unconformable on Miocene, and subaerial Pliocene gravels all about the Santa Clará Valley. The Miocene he divides into two groups; one a fine grained slate or shale often highly bituminous and the other a rather coarse grained sandstone, the latter being the lower member. He makes the general uplift post-Miocene with many local movements since Pliocene, the Miocene and Pliocene being conformable in some places, in others unconformable.

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* Geological Survey of California, J. D. Whitney, State Geologist. Geology, vol. i, 1865, pp. 61 *et seq.*

† Auriferous Gravels, J. D. Whitney. Memoirs of Museum of Comparative Zoology, 1880, pp. 15 *et seq.*

Becker.—In 1888, Dr. Becker.* in his report on the "Quicksilver Deposits of the Pacific Slope," also makes the metamorphic rocks Cretaceous, but thinks the limestone is the lowest member and probably older. He thinks the first upheaval took place in lower Cretaceous. The cherts before mentioned he calls phthanites and argues that the serpentine is derived from sandstone.

Cooper.—In the Seventh Annual Report of the State Mineralogist, Dr. J. G. Cooper † gives a list of the fossils of California with their geographical and geological range. This is a good index of the ages to which some of the more fossiliferous horizons were assigned at that time and practically up to the present. The following ages are given to some of the beds to be discussed later. The horizontal beds from Santa Barbara to San Diego are all called Quaternary. The beds of Seven Mile Beach and their continuation to the southeast are called Pliocene. The fossiliferous beds along the coast from Half Moon son* suggests that the White Miocene shale or Monterey shale is of volcanic origin. Gravels which he finds there overlying the granite he thinks are of Eocene age. He also differentiates the Pliocene and Quaternary. In a later paper† he summarizes the evidence of post-Pliocene uplift between San Diego and San Francisco. He describes in a general way the beds on Seven Mile Beach and their structure, calling them all Pliocene and naming them the Merced series. He makes them continuous with the beds in the cliffs at Pillar Point, giving a section from Lake Merced to Pillar Point.

A number of other geologists have touched the Santa Cruz Mountains, without their reports giving us any new information on the main features of the geology. As for example Dr. J. S. Newberry‡ and Dr. Thos. Antisell.§

GENERAL GEOLOGY.

Formations Represented.—The Pleistocene is well represented in belts of nearly level ground, which skirt the mountains on all sides, and form benches up many of the streams.

The Pliocene is recognized on Seven-Mile Beach and to the southeast. Merced series.

The Miocene is the formation which predominates. Three facies are recognized. The lower part of the Merced series, very fossiliferous, yellow and drab sands more or less consolidated; the Monterey series, principally a light colored bituminous shale, containing few fossils; the Pescadero series (in part), represented by wide spread yellow sandstone, fossiliferous in places.

The Eocene is thought to be represented, but no faunal evidence of its presence has been found.

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* Univ. of Cal., Bull. Dept. of Geol., vol. i, pp. 1 *et seq.*, May, 1893.

† Univ. of Cal., Bull. Dept. of Geol., vol. i, pp. 115 *et seq.* Dec. 1893.

‡ Pacific Railroad Survey, vol. vi, part ii.

§ Pacific Railroad Survey, vol. vii, part ii.

The Cretaceous is thought to be represented. The strata containing lower Miocene fossils form the upper part of a series several thousand feet thick. (Pescadero series.) No fossils were found in the lower part of the series, but it seems probable that the Inoceramus reported by Prof. Whitney came from these beds, and partly upon that as a basis they have been referred to the Cretaceous.

In addition to the above are areas of granite and limestone that are probably pre-Cretaceous.

There are large areas of metamorphosed sandstones, phthanites, serpentines and associated rocks, shales and older eruptives, of which the age is as yet in question.

*Distribution of the Formations**—Granite.—While from the position and character of its outcrops it seems to be evident that the granite has considerable body underneath, its outcrops are not very conspicuous in the Santa Cruz Mountains. It occupies the ridge running from a little south of Point San Pedro nearly to the San Mateo-Spanish Town road; also the ridge on the west of the San Lorenzo River, which extends from near Santa Cruz nearly to Pescadero Creek. A little granite appears at a few places southeastward. The main peaks shown upon the sketch-map and adjacent region.

Pescadero Series.—This series makes up the hills of northeastern San Francisco. The eastern side of the San Bruno Mountains and hills northwest of Ocean View. At Point San Pedro. Eastern foothills, from Redwood-Searsville road to south of Mayfield. Main ridge, from San Mateo-Spanish Town road to headwaters of Pescadero Creek. Pescadero Point to Pigeon Point.

Monterey Series.—Western flank of main ridge, from near Spanish Town, southeastward. Coast, from Point New Year to Santa Cruz.

Merced Series.—Lake Merced to Mussel Rock on the coast, and extending southeast to Milbrae, forming foothills. Foothills near Stanford University and Mayfield. Foot of main ridge, west side of Coal Mine Cañon. Coast, from Point Montara to Pescadero Creek. At Point New Year. Santa Cruz to south of Capitola.

Pleistocene and Recent.—Most of San Francisco. Valley of Lake Merced. Between foothills and Bay of San Francisco. Santa Clara Valley. Small areas in foothills and in stream valleys. Mussel Rock to Point San Pedro. Raised beaches on coast, from Point Montara to Pajaro River. Valley of Pajaro River.

Stratigraphical Relations of the Formations.—There are three, and probably four, marked periods during each of which sedimentation was more or less continuous, each being followed by upheaval and folding, and each being laid down unconformably upon the preceding. The formations belonging to the first of these have been grouped together and have been called for want of a better name,

The Metamorphics of the Coast Ranges.—These include the Gavilan limestone, the phthanite or radiolarian chert and the metamorphic sandstone. Little is known accurately of these formations. The phthanite and metamorphic sandstone appear to be conformable, the sandstone certainly underlying and probably overlying the phthanite. Beyond that, the relations of the formations to each other are not known. There appear to be two beds of the Gavilan limestone, one of which at least is several hundred feet thick. The limestone is found associated with the metamorphic sandstone and metamorphic slate, also with younger formations where brought up by faulting. Dr. Becker,[*] in treating the rocks of the Gavilan Range, calls the limestone the lowest member. Its age is unknown. The phthanites, upon the evidence of Radiolaria found in them, have been thought to be of Jurassic or Cretaceous age.[†] In general, all the metamorphics are thought to be pre-Cretaceous by Mr. H. W. Fairbanks.[‡]

Above the metamorphics is a great thickness of sandstones and shale, frequently thin bedded, topped by heavy beds of conglomerate, which, to distinguish, we have called the

Pescadero Series.—This series comprises all the upper portion of what has been known as the San Francisco has been found to extend upward to the Tertiary, it will be assumed here, purely upon their evidence, that such a break does exist here between the metamorphics and the Pescadero series. The series has a thickness of several thousand feet.

During the next period of sedimentation there were laid down the two formations known as the

Monterey and Merced Series.—The Monterey series is a considerable thickness of white, or light colored, frequently bituminous, shale, with some sandstone, and is overlain conformably by soft sandstones, shales and conglomerates or grits, the whole, known as the Merced series, having locally a thickness of nearly a mile. The Monterey series contains but few fossils, those being of Miocene age. The Merced series is very fossiliferous, at the bottom containing many Miocene forms and at the top appearing to run nearly if not quite into the Pleistocene.

The two formations appear to grade into each other so that locally sedimentation seems to have been continuous from the beginning of the Monterey period at least through the Pliocene. On the other hand there is evidence of many minor movements during this long period, many parts of the area now covered by the formations having evidently been land areas during part of the time.

These two formations were laid down unconformably upon the preceding Pescadero series.

Unconformably upon all the preceding formations there are all around the edge of the Santa Cruz Mountains unconsolidated deposits of Pleistocene or Recent age. Locally, as just south of Mussel Rock and one or two other places, these reach a thickness of over two hundred feet; but generally they average from five to fifty feet in thickness. An interesting feature of these deposits is the part that wind-blown sands play in them, appearing at the bottom of the water deposits, and at the top covering a major part of San Francisco county.

General Structure.—As stated above, each of these periods of deposition has been followed by upheaval and erosion. These upheavals have been progressively gentler. On the San Francisco peninsula no distinction could be found between a movement which followed the laying down of the Pescadero series and a post-Jurassic movement which it is claimed followed the laying down of the radiolarian cherts and associated rocks.*

Both formations, whether distinct or not, were subjected to a powerful upheaval, being folded, faulted, crushed until a structureless mass has frequently resulted. The lower or so called metamorphic rocks have generally lost all trace of bedding, the phthanites excepted. In some places they show secondary silicification. The upper beds usually show bedding, though in many places this is lost and secondary silicification appears similar to that more common in the lower metamorphic rocks. High and vertical dips prevail in both formations.

Movement seems to have taken place largely by fault- [redacted] even running into the thousands. These faults and nearly all the structural features have a strike of about northwest and southeast.

As a rule the Monterey-Merced series are only gently folded, the strata usually having a dip lower than 45°, but locally the dip is frequently found to be as high as 75° or 80°. The axis of greatest disturbance seems to have been in about the same line as in the early Miocene upheaval. During the Merced period a volcanic outflow of andesite took place in the area of the foot-hills near Stanford University. Just above this is a layer of barnacles, cidaris spines, etc., and in places Pholas borings in it, with other evidence showing that the outflow formed later a part of the shore line. Other evidences of slight movements during the Monterey-Merced period are found in the distribution of the two formations. In places the Monterey series lies upon the granite, in others the granite or Pescadero series underlie the Merced series.

The folding, as a rule, has been sharper on the side of the mountains toward the bay. The fossils there are generally distorted and the strata are firmer and more consolidated. The most noticeable faults are also all on the northeast flank of the mountains. Along the exposure on the Seven Mile Beach, faults of from a few feet or inches up to ten or twenty feet are frequent; but aside from those only major faults have been recognized, and these partly by the distribution of the formations, partly by topography. There appear to be two main directions of faulting, parallel with the strike of the mountain, and in a nearly due east and west direction. The strata are generally tilted up at a high angle, often being perpendicular, but usually having lower dips as we recede from the line of greatest disturbance.

The Quaternary was a period of oscillation. During this period there was no folding but simple uplift with the axis of uplift as before in the axis of the range. The shore lines show that these movements of subsidence and uplift rested at a number of levels, the lowest subsidence being at least 1500 feet* below the present level. Prof. Lawson proposes as an hypothesis to differentiate the Pliocene and Quaternary; " that the Pliocene corresponds to the period of more or less continuous depression of the coast; and that the Quaternary corresponds to the more or less continuous uplift which has affected the coast since the maximum depression was reached."† This hypothesis would seem to meet the conditions along the southern coast, but will not those north of Monterey Bay, where the Pliocene has been upturned and eroded before the Quaternary was laid down and where land deposits form the bottom of the Quaternary. In that region the difference in the character of the uplift must be used, the Quaternary being only gently upraised and nowhere dipping more than a few degrees, while the Pliocene is lifted to angles of from 20° to 80°.

The movements of the Quaternary may be summarized ent site of San Francisco an island. Bay filling Santa Clara Valley.

4th. Recent uplift to present conditions.

Columnar Section of the Santa Cruz Mountains.

Quaternary.		Æolian deposits. Freshwater deposits. Marine deposits. Land deposits.	Elephas, conifers.	Thickness, 200 ft.+
Pliocene.	Merced Series.	Fossiliferous beds of sandstone and conglomerate. Transitional from the Miocene through the Pliocene.	Living shells. "Venus pajaroensis" (a Mactra). Large Pectens, Areas, etc. Cetacean bones.	Thickness, 4700 ft.+
Miocene.	Monterey Series	Bituminous or White Miocene shale; with some sandstone.	Infusoria. Pecten peckhami. Tellina congesta.	Thickness, 1000 ft.
Eocene?		Sandstones and conglomerates: Carmelo Series(?) Pescadero sandstones and shales.	Turritella hoffmanni. Ostrea titan. Liropecten estrellanus. Dosinia, etc.	Thickness, 2000-10,000 ft. (?)
Cretaceous		(The "San Francisco sandstone" in part.) Aucella beds.	Plant remains. Inoceramus. Aucella.	?
		Radiolarian chert or phthanite. Metamorphic sandstone.	Radiolaria.	Thickness, 400 ft.+
?		Gavilan limestone.	Foraminifera.	Thickness, 300-1100 ft. (?)

DETAILED STRATIGRAPHY.

In a more detailed study of the stratigraphy, the formations will be taken up from earlier to later. The metamorphic sandstone will be considered as at least a more or less marked facies of the pre-Miocene sandstones. The future will decide whether it be simply a metamorphic facies of the lowest bed of the great series which have been known as the San Francisco sandstone, or whether this term has been applied to beds differing not only in age, as it is quite probable that they do, but in all their structural relations. The evidence observed will be given under the relations of the Pescadero series.

LIMESTONE.

Lithology.—This bed of limestone is in places highly crystalline, in other places it does not appear to be so much metamorphosed, and contains long lenticular masses of chert through it in the direction of dip. Prof. Whitney describes it in one place as follows*: "The upper layers are thin bedded, and some strata are light colored, others dark; below the stratification is less distinct, the layers heavier and the rock more crystalline."

between the San Andreas and Crystal Springs Valley and Pilarcitos Valley, from the San Mateo-Spanish Town road, where it used to be quarried, northward a few miles. Near the head of Stevens Creek it outcrops and is well exposed along the hill on the east of the valley; also further east, evidently having been faulted or folded.

Blocks and small outcrops were found at a number of places, but from their occurrence were generally thought to be only fragments brought up by faulting.

Relations and Age.—Aside from some indications that this limestone occurred low down in the series, no definite relations could be made out between it and other formations exposed. In the Gavilan Range, Becker makes it "the lowest sedimentary formation encountered."* From the association with it there of rocks of the Archæan gneiss type, he thinks it may be very old, though he suggests the possibility of its being a member of the Knoxville series of the Lower Cretaceous.

In the section up Permanenta Creek there seems to be some evidence that it is a conformable member of the series containing the phthanite and metamorphic sandstone, and would seem to underlie the phthanite by some distance. No good outcrop of the phthanite occurs on the creek, but its position is indicated by fragments in plenty. Between it and the limestone the bedding in the sandstone and shale is very indistinct, but in several places indicated a dip and strike, which is found to agree with the dip and strike of the limestone when that formation is reached further up stream.

PHTHANITES, OR RADIOLARIAN CHERT.

Lithology.—Nearly every writer on the geology of California has noted or described a series of thin-bedded, cherty strata, ranging in color from red or green to brown or black. They are usually very thin-bedded, averaging about an inch, but ranging from a fraction of an inch to several inches. They are very hard, and break up into little parallelopipedons. Almost everywhere they are exposed, the strata are very much and very characteristically contorted, yet maintaining their bedding almost unbroken, like the edges of a bale of cloth which has been crumpled up.

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* U. S. Geol. Surv., Monograph xiii, p. 181.

It has recently been shown that in places the phthanite contains an abundance of Radiolaria, though in poor preservation.*

From this it has been thought that the phthanites were originally silicious deposits, the silica having been derived from organic remains.

Occurrence.—Small outcrops of phthanite are abundant, and it frequently appears to be all mixed up with the sandstone, serpentine, etc., as though in the crushing to which the metamorphics had been subjected the phthanite bed had been torn into small masses which had been thoroughly scattered among the other beds. That we do not observe the same thing for the other beds is doubtless due to the fact that, as a rule, we have no way of noting rock in the line of hills from Point Lobos southeastward past the almshouse to the hills just north of Visitacion Valley on the bay side. This belt includes Bernal Heights. It is not confined to this belt, and usually may be found wherever the serpentine or metamorphic sandstone occurs. As typical exposures readily accessible from San Francisco might be mentioned exposures in the small hill in the northeast corner of Golden Gate Park; also in the hill near Strawberry Hill, in the same park, upon which the Prayer Book Cross has been erected. In numerous cuts in the group of hills surrounding the almshouse, and in fact nearly everywhere that it occurs in any quantity, it is much quarried for road material and hence the abundance of excellent exposures.

Relations and Age.—The evidence, both on the San Francisco peninsula and elsewhere, makes it appear that the phthanite is conformably interbedded with the older sandstone. Mr. F. Leslie Ransome reports this relation to exist just north of the Golden Gate and on Angel Island.* It may therefore be considered as of the same age. By a comparison of its radiolarian fauna with that of certain cherts of Europe, it has been thought that the phthanite might be of Jurassic or Cretaceous age.†

THE METAMORPHIC SANDSTONE.

Lithology.—In the area studied a metamorphic sandstone is very abundant in which bedding is visible in only a few places, and then can be followed, as a rule, but a few feet. It is usually light brown or gray in color, rather fine grained, but variable in that respect, breaking along joint planes which seem to form a fine network through it and which are generally stained brown or black.

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* Univ. of Cal., Bull. Dept. of Geol., vol. i, pp. 73–74, and pp. 198, 199.

† Univ. of Cal., Bull. Dept. of Geol., vol. i, pp. 237–238.

In many places over considerable areas hand specimens show a schistose structure full of slickensides and evidently bearing no relation to its original structure and character, sometimes appearing as though it had been reduced to a pasty mass and afterward consolidated.

In many places this old sandstone is further distinguished by secondary silicification, the rock being filled with a net work of fine quartz veins.

In some regions the metamorphic sandstone can be recognized at once. In others the resemblance to the sandstone of the Pescadero series is so great that it is impossible to draw the line between them. For example, in the San Bruno Mountains the northeastern side is clearly made up of the Pescadero sandstones showing the bedding and characteristic features. As the southern end of the mountain is rounded the bedding becomes more obscure and the dip less regular; this continues, the beds being found at all angles until finally the bedding only shows here and there, phthanite occurs to some extent, secondary silicification is quite marked in some places, and the rock as a whole on the west side of the mountain

As, however, most of the recent observers agree in placing a marked non-conformity between the metamorphic rocks and the Cretaceous rocks, with the latter of which the Pescadero series has been thought to, in part, agree, the writer has preferred in this paper to accept their conclusions.

Occurrence.—The metamorphic sandstone occurs in connection with phthanite or serpentine in most of hills included in the broad belt which extends from Fort Point and Point Lobos southeastward to the bay between Mission Bay and Visitacion Valley. It also forms the southwestern flank of the San Bruno Mountains.

It is found abundantly on the edge of the foothills facing San Francisco Bay from Milbrae to Redwood City; on the ridge which starting from Mussel Rock extends southeast on the west side of San Andreas and Crystal Springs Valleys. Also in Black Mountain and southward, and in general wherever the metamorphic rocks are found. In the Santa Cruz Mountains much of the eastern slope and the highest peaks are made up of the metamorphic sandstone and associated rocks.

Relations.—From the lack of bedding or structure it is seldom that any relation can be made out between the metamorphic sandstone and the other formations. The only relation so far observed is that it lies conformably under the phthanite and probably also above. This appears in several of the phthanite hills in San Francisco, notably on Castro Heights. Mr. F. Leslie Ransome reports the same relation to exist north of the Golden Gate* and on Angel Island.†

Correlation.—No fossils have ever been found in the metamorphic sandstone of the San Francisco peninsula.

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* Univ. of Cal., Bull. Geol. Dept., vol. i, pp. 73-74.

† Univ. of Cal., Bull. Geol. Dept., vol. i, p. 198.

Its age is therefore not known. From its association with the phthanite it has been thought to be of about the same age, and so is called Jurassic by some. Assuming the existence of a nonconformity between these rocks and the Cretaceous, it may be best for the present simply to consider them as pre-Cretaceous.*

THE PESCADERO SERIES.

The San Francisco sandstone was one of the earliest formations recognized and described in this State. Of late, however, as intimated above, it has been thought that the formation originally described under the name San Francisco sandstone, instead of being one formation represents at least two of very differing ages. In most, if not all, the recent papers the California or San Francisco sandstone has been assumed to belong to the pre-Cretaceous series. But the writer has found that a large part of what was originally described as the San Francisco sandstone belongs to a series which certainly is in part Miocene, as at first described by Blake, probably in part Tejon and possibly in part Cretaceous. The best exposure of the series was found in the low bluffs near Pescaocene fossils. It is now believed that Blake was right in placing these with the San Francisco sandstone.

The sandstone and shale, which is quite typically developed in Telegraph Hill and other hills in the northeastern part of San Francisco, is found making up a large part of the San Bruno Mountains, just south of the city. It is then found typically developed at Point San Pedro and again at Pescadero Point. The section there gave a thickness calculated at 10,800 feet. Near the southern end of this section are several hundred feet of conglomerate, and in this conglomerate were found *Turritella hoffmanni* Gabb, and a few other forms, not yet identified. In the headwaters of Stevens' Creek and Coal Mine Cañon occurs a conglomerate indistinguishable from the conglomerate near Pigeon Point, and also containing *Turritella hoffmanni* Gabb, together with *Liropecten estrellanus* Conrad, Ostrea and Dosina. Again, in Alum Rock Cañon in the Mt. Hamilton Range, near San José, are found similar sandstones and conglomerate with a similar fauna, and containing also the characteristic *Ostrea titan* Conrad, and some other forms.

The Pescadero section has thus served as a key, showing as it does in continuous section rock very typical of the old San Francisco sandstone, as developed in San Francisco, and conglomerate identical in appearance and fossils with the somewhat abundant fossiliferous sandstones and conglomerates underlying the White Miocene shale.

The writer visited the original locality from which Professor Lawson described his "Carmelo Series," and is inclined to the belief that the Carmelo series will be found to be the equivalent of the conglomerate of the Pescadero series.

In the Coast Range Mountains of Southern California, Dr. Antisell studied the lower Miocene strata in some detail. It is believed that the strata described by him will be found to belong to the Pescadero series.

Petrography and Stratigraphy.—This formation may be described under three facies, the first two of which everywhere grade into each other, the last being more distinct.

The first is typically developed at Point San Pedro and the neighboring bluffs. The exposure consists of dark and black shales and slates, or shaly sandstones which, while showing finer bedding, is distinctly bedded in layers of from one to three inches or upwards. Many layers of coarse grained, sometimes conglomeritic, grey or white hard sandstone or quartzite occur interstratified in that series. This sandstone, while sometimes heavily bedded, is not in continuous layers, but constantly varying in thickness and sometimes disappearing altogether. At the top of the point, where the nearly vertical shales have been deeply weathered, they have become the same in appearance as the soft yellow sandstones which in other regions have been assigned to the Miocene age, as, for example, the sandstone exposed along the top of the ridge west of Woodside and Searsville. The bedding being distinct. In other places the strata are very heavily bedded, and frequently so intersected with joint planes that it is difficult to make out the real bedding. In many places these sandstones were observed to be peculiarly and quite characteristically weathered, so as to give the surface a pitted or honeycombed appearance, the cells being from a fraction of an inch up to five or six inches across. The resisting cell walls have probably been hardened by iron which has infiltrated into the network of joint planes. At Point San Pedro these strata lie upon the granite, and are largely made up of granite boulders and fragments. The proportion of granite increases as the main granitic mass is approached, until it becomes difficult to recognize the separating line.

These two facies were not found occupying definite horizons, but, as in the Pescadero section, grade into each other, and succeed each other irregularly in the vertical section.

The third facies is more characteristic. It is a conglomerate, heavy bedded, and apparently made up of the rocks of the metamorphics, fragments of phthanite being particularly abundant. This conglomerate is usually quite hard, the included fragments breaking across where a piece of the rock is fractured. The rock is usually brown or dark colored, except where relieved by the red or other colors of the phthanite. The pebbles are usually not very large, varying from an inch or under to three or four inches in diameter. They are frequently found to be distinctly faulted.

The conglomerate of Carmelo Bay is laid down upon granite and contains considerable granite, which the conglomerates of the Santa Cruz Mountains do not, as far as observed. This is, however, due to local conditions and may not affect the main question of their original continuity.

As previously stated, the best section observed was that running from Pescadero Point almost to Pigeon Point. (Plate xxiv). The strata are almost perpendicular for the whole distance of over five miles; at the northern end disappearing under some gently dipping strata, and at the southern end, where the dip of the beds becomes lower, being cut off by a fault. The section was made by pacing and abundant observations upon the dip and strike, corrected by the U. S. Coast and Geodetic Survey chart of that region. The section was not examined in great detail, and the frequently varying strike gave room for the presence of faults; but though carefully watched for, none were found of any magnitude except the one at the south end of the section. The section gave a thickness of nearly 11,000 feet, composed, with the exception of 600 feet of conglomerate at the southern end, of the thin bedded and heavy bedded sandstone, changing rapidly from one to the other all through the section. The predominating layers average from three inches to a foot series belongs to the Miocene Tertiary, which hardly seems probable. If the conglomerate is the uppermost member, then the series may be the result of continuous sedimentation through part or all of the Cretaceous and Eocene. It is not easy on the latter theory to explain the presence of such large quantities of the metamorphic rocks, which presumably had just been buried beneath the rest of the section, unless we assume considerable erosion previous to their laying down. In the Pescadero section no evidence of a break was observed; the conglomerate seems to run into the thin-bedded sandstone, the strike and nearly vertical dip being the same in both.

The conglomerate of the Carmelo series was laid down upon granite. If it is rightly correlated with the conglomerate of the Pescadero series, then the conglomerate of Pescadero must represent the bottom of the series or else there must have been uplift, erosion, and exposure of the metamorphic rocks between the laying down of the conglomerate and the rest of the series, notwithstanding the evidence to the contrary at Pescadero. This uplift and exposure may have been local. As the evidence seems to favor the latter theory it will be taken tentatively here.

Professor Lawson estimated the Carmelo series to have a thickness of at least 800 feet.* The conglomerate at Pescadero was estimated to have a thickness of 720 feet at least. Blake gave the San Francisco sandstone a thickness of 2000 or 3000 feet.†

Dr. Antisell, working south of the Santa Cruz Mountains, obtained the following section of the strata below the White Miocene shale.

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* Univ. of Cal., Bull. Geol. Dept., vol. i, p. 19.

† Rep. Geol. Recon. in Cal., 1858, p. 153.

"Grits and calcareous sandstones, as at Panza and Santa Margarita	360 feet.
San Antonia sandstones, with Dosina, etc	250 feet.
Gypseous and ferruginous sandstones of Santa Inez, Panza and Gavilan, containing Ostrea, Turritella, etc."*	1,200 feet.
Or thickness below White shale	1,810 feet.

Occurrence.—The Pescadero series is well exposed at a number of points about San Francisco Bay. At Benicia, Blake found in rocks of this series a Trochus, Turritella and shark's tooth. In San Francisco it makes up the three hills in the northeast, or business quarter, of the city. The hills just north and west of Ocean View and most of the San Bruno Mountains belong to this series. It is finely exposed at Point San Pedro and at Pescadero. It appears to be one of the most abundant formations of the Santa Cruz Mountains. It occurs abundantly in the Mount Hamilton Range and to some extent in the Mount Diablo Range.

If it be correctly correlated with the lower Miocene strata worked up by Mr. Antisell, it will probably be found that this formation is widespread all through the

Quaternary. The age of the overlying strata was not determined, as they differed petrographically from any rock found elsewhere. Their position and structure would seem to indicate that they belong to the Monterey series. In San Francisquito Creek, above the Mayfield-Searsville road, the Pescadero series with a high dip is overlain by the gently dipping Merced series; and as the Merced and Monterey series are found to be conformable, that would place the Pescadero series unconformably below the Monterey series.

At Carmelo Bay Dr. Lawson believes a nonconformity exists between the Carmelo series and the White Miocene shale or Monterey series. In the same place the Carmelo series is seen resting upon the granite.* At Point San Pedro the formation also rests upon the granite,

Correlation.—The fossiliferous formations just underlying the White shale that are described by Dr. Antisell and Prof. Whitney are believed to be correctly correlated with part of the Pescadero series. Their Miocene age can hardly be questioned.

An attempt to work out the faunas of the three divisions made by Dr. Antisell for the strata below the White shale was only partly successful. The following is a partial list:

c. The grits and calcareous sandstones.
    Ostrea titan Conrad.
    Ostrea panzana Conrad.
    Hinites crassa Conrad.
    Pallium estrellanus Conrad.
    Cyclas permacra Conrad.
    Balanus estrellanus Conrad.
    Asterodapis antiselli Conrad.
b. The San Antonio sandstones.
    Dosinia alta Conrad.
    Dosinia montereyana Conrad.

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* Univ. of Cal., Bull. Geol. Dept., vol. i, p. 7.

Dosinia montana Conrad.
Dosinia longula Conrad.
Dosinia suboblique Conrad.

a. The gypseous and ferruginous sandstones.
Mytilus inezensis Conrad.
Pachydesma inezensis Conrad.
Turritella variata Conrad.
Ostrea.

The gypseous and ferruginous sandstones do not seem to have been very fossiliferous and are associated with conglomerate and lignitic layers. They would thus seem to have some similarity to the Carmelo series of Lawson.

Among the specimens found at the head of Stevens' Creek were the following:

Ostrea sp. ind.
Liropecten estrellanus Conrad sp.
Turritella hoffmanni Gabb.
Dosinia sp. ind.

Ostrea titan has been found near this point.

In Alum Rock Cañon in what are thought to be the same beds were found:

Natica sp.
Ostrea titan Conrad.
Liropecten estrellanus Conrad sp.

Eocene at Mount Diablo. In Alum Rock Cañon, near San José, a piece of float rock was found to contain what were thought to be Nummulites, though only cross sections could be obtained. The genus Nummulina, though known to exist from the Carboniferous to the present, is only known to have attained a considerable size and to have been of any geological importance in one age, the Eocene. The evidence of the fucoids near Haakerville is of only minor importance, but must be taken into consideration.

If, as the structure suggests, the conglomerate in the Pescadero section is near the top of the series, it would seem possible that the great thickness of strata below represent not only the deposition of the Miocene, but possibly also of the Eocene.

In conclusion, it may be stated that below the White Miocene shale or Monterey series of the Miocene, there has been found to lie, unconformably, a series of sandstones, shales or shaly sandstones and conglomerates, having a thickness of several thousand feet, in part, at least, of older Miocene age, and possibly extending back through the Eocene.

THE MONTEREY-MERCED PERIOD.

The Monterey series was among the earliest of formations described in California. It was assigned to the Miocene, and later investigations have not modified that decision.

The first mention of the Merced series was by Whitney, who merely mentions the finding by Gabb and Remond of Pliocene strata on Seven-Mile Beach.* These beds seem to have commanded little attention until recently. They were recently described more in detail by Professor

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* Geol. Surv. of Cal., Geology, vol. i, p. 79.

Lawson, by whom they were called the Merced series.* They have been called Pliocene by all who have worked with them. From Half Moon Bay southward, at a number of places, occur very fossiliferous beds, which have often been mentioned or referred to, but of which little has been written. The fossils obtained from these beds have been referred by some to the Miocene, by some to the Pliocene. The same beds have been referred to the Pliocene where little disturbed, and to the Miocene where much disturbed.

The field work done by the writer has seemed to show:

1. That, though minor oscillations have occurred, there has been continuous sedimentation from the beginning of the Monterey series to the end of the Merced. (Due to minor oscillations, this is not always true locally.)

2. That the two are similar in structure, that structure having been received from the movement which took place at the end of the Merced period.

3. That the fossiliferous beds south of Half Moon Bay are conformable with the Monterey series below them and the Merced series above them.

to simply call them the "transition beds" of the Merced series, grouping them with the Merced series because petrographically they are similar to the predominating rocks of that series.

THE MONTEREY SERIES.

Lithology.—The Monterey series or formation, or, as it is variously known, the White Miocene shale, or Bituminous shale, is the most characteristic formation of the Miocene. It is for the most part nearly white or light buff in color, of a shaly, porous character. It is quite soft and without grit, yet resisting weathering to a remarkable degree, loose fragments or artificial exposures maintaining their sharp edges. It is usually quite thin bedded, the bedding being very distinct. It is generally cut up by joint planes which determine the surfaces of fracture. The porosity has been found in some cases to be due to the leaching out of minute shells, probably foraminifera. This shale has distributed through it some carbonaceous material, which, though not generally showing, except occasionally as small black specks, gives rise to the bituminous springs and deposits so common along the coast.

Near Santa Cruz, apparently underlying but probably part of the same formation, is a black bituminous rock, like a coarse grained sandstone, in which the matrix is bitumen. Large quantities of this rock are shipped to San Francisco.

At places, as on Bald Knob near the road down Tunitas Creek, the shale appears to be silicified into chert or chalcedony or sometimes resembling opal. It maintains its white color and bedding.

At Monterey and other places it is very rich in infusorial forms, diatoms, sponges, etc., so that it has been considered as a vast deposit of such forms. Recently Professor Lawson* has advanced the suggestion, upon chemical and microscopic examination, that the White shale is of volcanic origin. He estimates its thickness at over 1000 feet.

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* Univ. of Cal., Bull. Dep. Geol., vol. i, p. 24.

There is, however, one feature which would seem to contradict that theory. At Santa Cruz and for a short distance south, the bluffs are formed of the fossiliferous Transition beds. The structure is a shallow syncline. Plate xxiv. Going north from the lighthouse the lower of the Transition beds are crossed, as shown in the section, plate xxiv, and the top of the White Miocene shale reached. As the bottom of the Transition beds is approached, the beds take on more and more the character of the White Miocene shale until before the parting is reached they become indistinguishable from it, showing that the conditions held over from the one period to the other. Further, as mentioned below, its apparent existence in the middle of the Merced series on Seven Mile Beach.

Occurrence.—The White shale is almost wanting on the northeastern slope of the mountains. A small exposure occurs on the Menlo Park-Searsville road, a mile or two from Searsville; also, on the road on top of the ridge, half a mile south of the Searsville-Pescadero road. But the coast side of the mountains, the question naturally arises, what has become of this formation on the bay side, where only one small outcrop near Searsville has been noted? The most acceptable answer is that it has been eroded to that extent. As we shall see under the discussion of the Merced series, that formation in places rests upon the granite and older strata; the fragmentary character of the outcrops of White shale on the east side of the mountains is strengthened by the further evidence of great erosion. Faulting may also play an important part in its present distribution.

Outside of the Santa Cruz Mountains the White shale is found abundantly over a large area, occurring for several hundred miles along the coast.

Relations.—The relation to the underlying rocks has already been discussed. In the Santa Cruz Mountains it is believe to overlie unconformably all the older formations, in some places lying upon the granite, in others upon the Pescadero and older series. In the sections given by Dr. Antisell from the southern part of the State, the White shale is uniformly represented as conformable with the underlying Miocene.*

The relation to the Merced series will be treated under the relations of the Merced series.

Correlation.—The White Miocene shale is generally very unfossiliferous, but characteristic fossils have been found at a number of places, notably at Monterey.

A few fossils were found by Dr. J. P. Smith near the summit south of Searsville. They were identified as follows:

Pecten peckhami Gabb.
Lucina borealis Linnaeus.
Pandora conf. scapha Gabb.
Nucula sp. ind.

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* Report on Pacific Railroad Survey, vol. vii, pls. i *et seq.*

Blake reports* the following from this horizon:

Tellina congesta Conrad.
Meretrix traskii Conrad sp.
Mercenaria perlaminosa Conrad.

In addition Professor Lawson notes† the following forms:

Arca sp. (Nov.?)
Saxidomus sp.
Leda sp. (Nov.?)
Lucina like L. crenulata.
Clementia? sp.
Young Cardium, or small Venericardia.
Macoma sp. (Nov.?)

Among those mentioned by Gabb in vol. i of the Paleontology of Cal. is *Turritella hoffmanni* Gabb.

Though none of these species except *Lucina borealis* Linn. occur on the east coast, by a comparison of similar forms Conrad concluded that this formation was Miocene. And as we have both above and below species almost identical with Miocene species of the east coast, we may accept his determination.

THE MERCED SERIES.

The beds which will be assigned to this division have

Mile Beach becoming over 700 feet high. It is doubtful if there is anywhere in America a Tertiary formation presenting so many advantages and attractions for study. That it is intimately concerned in the structure of the mountain, that it is cut and interbedded by igneous eruptions, and that during the deposition of its nearly a mile of sediment a gradual but marked change in the fauna can be traced, increases the interest it must have for the student.

Petrography.—The Merced series of the Santa Cruz Mountains is composed of a great thickness of partly consolidated sands, clays, argillaceous sands and hard, fine conglomerates. On the bay side of the range the strata have felt the mountain-making forces more, and are usually harder and, as shown by the distortion of the fossils, more crushed. Local metamorphism and minor variations will be mentioned later. The most abundant and characteristic rock is a dark drab or slate colored argillaceous sand, breaking into small fragments of about half an inch cube, which in many places are bright red on the joint faces. In places it shows a yellow ochre-like deposit. It varies in hardness from that which crushes easily in the hand to tough and more argillaceous varieties which are like a hard clay. Locally it sometimes forms very hard nodules or layers, generally due to the lime from inclosed shells, many of the shells collected being obtained by splitting open these nodules. In places this sandstone is thin-bedded, but it is more apt not to show many bedding planes in a thickness of 100–200 feet. This rock makes up the most of the long hill at Point Pillar, and likewise much of the bluffs to the south and on Seven-Mile Beach.

The next most abundant rock is a yellow or buff colored sand, generally quite soft; sometimes it weathers in the bluffs until it seems to be filled with great pot-holes.

Just below the sheet of basalt south of Stanford University the sandstone is coarse grained, nearly white and very hard. Above the sheet of basalt it has been leached out until the fragments on the surface are almost as porous as a sponge.

Along the Seven-Mile Beach in particular there are many thin layers of hard conglomerate. The pebbles are usually water-worn fragments of phthanite and the other metamorphics, usually less than an inch in diameter. These layers are, as a rule, very hard and seldom more than a foot or two thick, though sometimes there are many layers close together. At several places along the Seven-Mile Beach section they resist weathering and stand out very prominently from the softer surrounding strata, one layer at lowest tide being traceable several hundred feet out into the ocean. Most of these fine conglomerates contain many commuted fragments of shells, which may account for their hardness. In some the proportion of shell fragments becomes so great that they would more properly be called shell breccias or brecciated limestone. Such a breccia outcrops quite prominently in the foothills west of San Bruno; also along the con-still shows, but in most cases it is invisible macroscopically.

At the top of the section along Seven-Mile Beach, the sandy strata become quite soft—there are found to be no hard strata. As we rise in the series the strata become more and more unconsolidated and sandy, the upper layers consisting almost entirely of yellow and orange sand.

Fine gravel occurs in some abundance, and there is a little coarse gravel, but in no case is it consolidated into a conglomerate.

The most noticeable layer in this upper series is a white, chalky layer, which Dr. Lawson* considers a volcanic ash. On the beach it appears as a bed having a uniform thickness of about one foot, interbedded with the other strata. At one point on the northeast slope of the bluffs, near the head of Lake Merced, it has a thickness of six feet. The Spring Valley Water Works Company mine it here for "chalk." Under the microscope it shows no crystalline structure, nor could any diatoms or foraminifera be made out; a chemical analysis would probably throw much light on its composition and origin.

Stratigraphy.—The best section obtained was that along Seven-Mile Beach. This section gives probably a nearly complete series at the top. The bottom of the section, however, is about 670 yards north of the contact with the igneous rocks of Mussel Rock, so that the section is not complete; but the dip at this point becomes low, and there is abundant evidence of faulting, so that it is not thought that more than a few hundred feet are omitted.

A study of the contact between the Merced series and the igneous rocks from Mussel Rock southeastward shows, however, that the bottom of the series has not been exposed on Seven-Mile Beach; in other words, that the Merced series was not laid down upon the igneous rock of Mussel Rock, the contact between the two formations being plainly a fault contact. The absence of a large part of the Transitional beds is evidence in the same direction.

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* Univ. of Cal., Bull. Dept. Geol., vol. i,p. 144.

This section does not include the fossiliferous Transition beds, of which no section was obtained. They would probably carry the strata downward several hundred feet, the rock being similar to the drab and pink argillaceous sand so common above.

The following is the

Section of Merced Series along Seven-Mile Beach:

		Feet.
72	Variable layers of soft, yellow and orange sand	200
71	Light colored argillaceous sand	6
70	Hard ferruginous layer of brown sand	1
69	Yellow and orange sand	8
68	Hard layer light yellow sand	1
67	Yellow sand	8
66	Sand and fine gravel, cross bedded	12
65	Layer of "Volcanic ash" of Lawson	1
64	Yellow and orange sand	15
63	Coarse gravel scattered in orange sand	4

		Feet.
50	Sandstone with fossils	40
49	Many thin layers of conglomerate and shell fragments	20
48	Sandy layers	125
47	Conglomerate	2
46	Sand	10
45	Conglomerate with *Scutella interlineata* Stimp	5
44	Yellow sandstone	30
43	Yellow sandstone with many layers of fine conglomerate	20
42	Yellow sandstone with *Scutella interlineata* Stimp.	15
41	Yellow sandstone	55
40	Thin layers of shells	10
39	Yellow sandstone	20
38	Lignite, several thin layers	
37	Yellow sandstone	25
36	Conglomerate with *Scutella interlineata* Stimp	20
35	Sandstone, containing many layers a few inches thick almost made up of *Scutella*	55
34	Bright yellow sandstone	20
33	Same with hard sandstone layers or nodules a few inches thick	10
32	Bright yellow sandstone with scattered shells and full of pot-like holes from a foot to several feet in diameter	145
31	Layers of fine gravel and conglomerate	20
30	Yellow sandstone with *Lucina*, etc	110
29	Drab sandstone with thin layers of lignite	10
28	Yellow sandstone	25
27	Lignite.	
26	Buff sandstone, showing a few scattered fossils	530
25	Same, showing layers of fine and coarse conglomerate with *Crypta*, *Olivella*, *Nassa*, etc	55
24	Drab clay with bright red jointing	6
23	Buff sandstone	235
22	Gravel and conglomerate with fossils, *Crepidula grandis* Con., *Standella californica* Con., *Scutella*, etc	10
21	Buff sandstone	60
20	Yellow sandstone with some layers of conglomerate	105
19	Layer of lignite from one to eight inches thick	
18	Yellow sandstone	65
17	Conglomerate, very hard, with *Scutella*	2
16	Light drab sand with many hard projecting layers of conglomerate	150
16	Same as above	195

		Feet.
15	Buff sandstone and drab clay with hard layers or nodules of sandstone, containing *Venus pajaroensis* Con., *Siliqua patula* Dixon, etc. Very similar to beds at mouth of Purisima Creek	220
	Conglomerate and shell fragments.	
14	Several layers full of *Crepidula grandis* Midd	15
13	Buff sandstone with *Venus* (Mactra)	10
12	Beds with Crepidula grandis Midd. every few feet	40
	Seam of lignite.	
11	Light drab sandstone, containing beds of conglomerate and shell fragments	100
10	Buff colored sandstone	250
9	Numerous scattered lamellibranchs.	
8	Buff colored sandstone	160
7	Lignite	1
6	Drab argillaceous sandstone with pink jointing, contains *Venus*, etc. Same rock as a Pillar Point	200
5	Same with few fossils. *Tellina*, etc	120
4	Drab argillaceous rock	192
3	Lower gasteropod beds. Several hard layers from 1-2 feet thick containing a great abundance of gasteropods, also *Scutella*, *Standella*, etc	18
2	Buff sandstone with few fossils	170
1	Buff sandstone	100
1	Buff sandstone	235

Total thickness of the section, 4740 feet.

gasteropod beds run all the distance and quite uniformly three feet apart. Their own thickness, however, varies from one to five feet, while the beds overlying them are entirely different in different parts of the course.

The section was made by pacing (corrected by map), the minor layers being estimated by rough measurement or by eye. Frequent landslides at the foot of the bluff make it difficult to get accurate measurements of many of the layers. At Wood's Gulch there was found to be a fault of 825 feet, downthrow on the south side. This was the only fault of any magnitude discovered, except those at the south end which could not be measured. Professor Lawson estimated the same strata to have a thicknoss of 5626 feet.* These beds appear to thin out to the southeast.

This section was the only one obtained, since the strata in the sections south of Point San Pedro have, as a rule, low dips and would require instrumental surveys to assure any degree of accuracy.

A little south of Point Montara this formation lies upon the granite. The lowest bed where it lies close to the granite is almost made up of pebbles and boulders of granite. In a short distance the proportion of granite rapidly decreases and the layer becomes very fossiliferous, gasteropods predominating, and from their resemblance to those of the lower gasteropod beds of the section on Seven-Mile Beach it is thought the two belong to the same horizon.

In the long hill at Point Pillar, the strata are excellehtly exposed dipping south, the dip being as high as 40° part of the distance. The same rock, the drab argillaceous sandstone with red joint faces, runs through the whole exposure. *Lucina borealis* Linn. is very abundant here and a few other Miocene forms were found. At Point Pillar the dip becomes horizontal or a little north and the stacks and long reefs seen at low tide show almost complete connection with the bluffs a mile south of Spanish Town. Here is the same rock containing *Crepidula grandis* Midd. From here to Pescadero Creek the same sandstone makes up the cliffs under the Quaternary wherever it was examined. In a low anticline south of San Gregoria Creek it was estimated that about 500 feet of strata were exposed. Layers of pectens were especially abundant at the center of this anticline. At Capitola the thickness actually exposed is small, the rock varying from very soft and friable drab sandstone to the hard layers of the same thing, lime from the contained shells probably causing the difference; the beds here are very fossiliferous and the fossils generally fairly well preserved. See plate xxiv.

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* Univ. of Cal., Bull. Dept. Geol., vol. i, p. 147.

These bluffs from Point Pillar to Capitola will doubtless yield excellent sections when a detailed study of them is made.

No exposure of sufficient continuity to yield sections from the south, the structure is seen to be anticlinal, so that the beds that make up the foothills run down on the north side of the anticline in the ridge through which the tunnel is cut. The gravelly deposits in Los Angeles give good evidence of being shore deposits, for the gravel seems to to be largely derived from the underlying formation and the boulders are pierced and sometimes almost honey-combed with borings of one of the rock boring mollusks.

Distribution.—The Merced series, antedating as it did the upheaval which gives the Santa Cruz Mountains its present topographic position, was probably originally laid down over all or most of the region now occupied by those mountains. The upheaval, however, seems to have operated largely by faulting, which resulted in some parts having been elevated and exposed to erosion more than others, so that the beds left now were probably under water during the Quaternary and thus preserved, and it is only the post-Quaternary uplift which has exposed them. As we might expect if this theory is true, we only find these Merced series beds on the lower flanks of the mountains probably not over 1000 feet above sea-level. They are exposed in the bluffs along the sea-coast from two miles north of Mussel Rock to Capitola at least, not continuously, however, for between Mussel Rock and Point Montara, at Spanish Town, and along the stretch north of Santa Cruz this formation is lacking, erosion having exposed the underlying strata or cut down the bluffs.

How far back into the mountains the Merced series extends was not accurately determined. In Purissima, Lobetas, Tunitas, San Gregoria and Pomponia creeks it was found to extend back at least four or five miles from the coast.

From Seven-Mile Beach the Merced series extends southeast in the direction of strike to Milbrae. From there to Redwood City the underlying metamorphics are exposed. South of Stanford University the foothills are fossiliferous and show the presence of this formation. It is also shown above Searsville in the lower part of the ravines running into the valley of San Francisquito Creek from the west and south.

Whitney* notes the presence of several hundred feet of this formation on the north flank of the Palo Scrito Hills.

It seems possible that most of the beds from which older Pliocene fossils have been reported will be found to correspond with this series. Dr. Lawson believes that the strata which he recently described as the "Wild Cat Series"† in Humboldt county may be correlated with the Merced series. Thus the fauna reported from Kirker's Pass and Green Valley, Contra Costa county; Santa Rosa and Russian River, Sonoma county; would suggest the presence of the Merced series.

Relations.—The relation between the Merced and Mon-creamy, fine-grained shale to the light or dark drab sandy strata characteristic of the Merced, and which can be traced to the fossiliferous beds of Soquel and Capitola. (See plate xxiv.)

At Point Montara the Merced lies upon the granite, and at several places in the San Francisquito basin the Merced series lies unconformably upon the Pescadero series. There is thus some evidence of erosion or transgression between the two periods.

South of Half Moon Bay the same relation seems to exist as at Santa Cruz, as indicated in certain well borings. On Purissima and Tunitas creeks wells have been sunk for oil to depths of from 600 to 800 feet. On Purissima Creek, about a mile from the village of that name, a well was sunk to a depth of 770 feet; oil was struck at 240 feet and from that depth downward. At that depth they also struck "some fossil clam shells."* Calling to mind the scarcity and character of the fossils of the white or bituminous shale it seems probable that these clams belong to the horizon of the fossiliferous beds in the bluffs on the coast. The suggestion is made that at that depth is the top of the bituminous or white shale. In one of the Tunitas Creek wells oil was reported at a depth of 350 feet. The well is 130 feet above sea-level and the dip of the shaly strata southwest. The above facts would indicate, if our interpretation is right, that the fossiliferous beds at Purissima, etc., are quite near the bottom of the series.

Some of the early writers grouped the fossiliferous or transition beds with the Monterey series, but it has seemed best for the following reasons to group them with the overlying Merced series:

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* Seventh Ann. Rep. of State Geologist for 1887, p. 101.

1st. Petrographically the beds are similar to the Merced series.

2d. Faunally there is a strong resemblance, many of the species, if not a majority, being common to both.

3d. They and the Monterey series differ petrographically, the White shale being a white, thin bedded, silicious shale, while the upper formation is largely an argillaceous sandstone, sometimes becoming an arenaceous clay, and sometimes becoming very sandy. The latter is seldom thin bedded, generally showing but few bedding planes in a considerable thickness. The thin beds of conglomerate of the latter have not been noted in the White Miocene shales.

4th. They differ greatly in their faunas. The White shale having a small fauna but sparsely represented, while the Transition beds as well as the Merced series have an abundant fauna, widely and abundantly represented. Further, of the species quoted as found in the White shale, only one species, the *Lucina borealis* Linn., has been noted among the Transition beds.

5th. The position of strata at San Fernando and Los exposed along Seven-Mile Beach. The section is not at right angles to the strike, so that the dip does not appear as high as it is. Some of the dips were 30° N. 9° E., 65° N. 9° E., 75° N. 14° E., 65° N. 24° E., 60° N. 14° E., 65° N., 65° N. 4° E., 67° N. 4° E., 35° N. 4° E., 30° N. 9° E., the line of section varying from S. to a few degrees E. of S. The bearings refer to the true meridian. The section gives a good idea of the upheaval to which these beds with the underlying beds were subjected.

Plate xxiv gives also a section from Lake Merced to Purissima. From this figure it is evident, if our conclusions are correct, that the uplift along Seven-Mile Beach is not a local uplift, but is intimately connected with the main recent upheaval, and that we must assign the mountains to an age later than the deposition of these beds.

Where the Santa Cruz Range is cut by the Pacific its structure would appear to be a simple anticline, rising probably more by faulting than by folding, and the different ridges due merely to erosion as influenced by this faulting. Thus, as already pointed out, there is a fault of 825 feet downthrow at Wood's Gulch, and evidence of this fault is found in the ravine which heads against Wood's Gulch and flows to the bay. About in this same line there is evidence of a fault in the north fork of Twelve-Mile Creek, and in a cut near the Happy Valley House. Just north of Mussel Rock a fault zone commences and continues to Black Mountain. This is evidently not a single fault, but seems to be a line of fracturing, The contact between the Tertiary and older formations which run southeast from Mussel Rock follows this fault line at least to San Andreas Lake. The bluffs along the northeast side of San Andreas, Crystal Springs and San Francisquito valleys appears to be due to faulting.

If the streams running from the foothills to the bay be examined it will be noticed that quite a number of them in the upper part of their course run nearly due east. It will also be noticed that in many of these cases the rocks exposed upon the two sides of the stream differ. This has led to the suggestion that a system of east and west faulting exists in the foothills, and that the streams have followed these faults.

All through the region, but especially at the northern end, are found small undrained basins, many of them containing standing water all the year. Several of these have been cut into in comparatively recent times by backward cutting streams, and fault lines exposed. This is very finely illustrated at the head of Wood's Gulch, where the faulting appears to have produced such an undrained basin, the fault scarp forming a perpendicular or overhanging cliff. Gradually the basin filled in against this face, partly by washing from the surrounding hilltops, partly by wind deposits, partly by fragments from the face of the cliff, until all trace of the fault is covered up, only to be exposed when erosion eats its way into the basin. Judging from those we can examine, these little basins are the result of faulting, and by an examination of the

	Pillar Point	Purissima	Lobetus	Tunitas Creek	San Gregoria Creek	San Gregoria	Capitola	Extinct	Living only Elsewhere
GASTEROPODA.									
Astyris gausapata Gould		*					*		
Calyptraea inornata Gabb ?		*						*	
Cancillaria tritonidea Gabb							*	*	
Chorus belcheri Hinds							*		
Crepidula grandis Middendorf		*			*	*	*	*	
Cryptochiton c. f. stelleri Middendorf		*							
Lunatia lewisii Gould		*		*	*	*	*		
Nassa californica Conrad						*	*		
Nassa perpinguis Hinds						*			
Natica clausa Broderip and Sowerby ?							*		
Neptunea humerosa ? Gabb						*		*	
Neptunea tabulata Baird		*				*			
Purpura crispata Chemnitz	*								
Purpura saxicola Valenciennes	*								
Surcula carpentaria Gabb							*		
Volutilites indurata Conrad		*						*	
LAMELLIBRANCHIATA.									
Acila castrensis Hinds		*		*					
Arca canalis Conrad ?		*						*	
Arca microdonta Conrad		*				*	*	*	
Arca sulcicosta Gabb		*					*	*	
Cardium corbis Martyn							*		
Cardium meekianum Gabb							*	*	
Chione simillima Sowerby ?							*		s.
Crytomya californica Conrad							*		
Cyrena californica Gabb							*	*	
Glycimeris generosa Gould						*	*		
Lucina borealis Linnæus	*	*	*				*		n. s.
Macoma edulis Nuttall ?							*		
Macoma nasuta Conrad		*				*	*		
Meretrix traskii Conrad ?							*	*	
Modiola flabellata Gould						*	*		s.
Mya truncata ?		*							
Pachydesma ineziana Conrad ?							*	*	
Pecten caurinum Gould	*					*	*	*	
Pecten pabloensis Conrad			*	*				*	
Pecten propatulus Conrad		*	*	*				*	
Psamnobia rubroradiata Conrad ?							*		
Sanguinolaria nuttalliana Conrad ?							*		
Saxidomus gibbosus Gabb			*	*		*		*	
Schizothœrus nuttalli Conrad			*				*		

	Pillar Point	Purissima	Lobetus	Tunitas Creek	San Gregoria Creek	San Gregoria	Capitola	Extinct	Living only Elsewhere
Siliqua patula Dixon sp							*		
Solen siccarius Gould		*		*			*		
Standella californica Conrad			*						
Standella falcata Gould						*?	*		
Standella nasuta Gould ?						*	*		
Tapes staminea Conrad							*		
Tapes tenerrima Carpenter				*					
*Venus pajaroensis Conrad	*	*	*	*		*	*	*	
Yoldia cooperi Gabb						*			s.
Zirphoea crispata Linnæus	*	*							
ECHINODERMATA.									
Scutella gibbsi Remond							*	*	
Scutella interlineata Stimpson	*							*	

Relations of the Fauna.—We have fifty-two species, of which eighteen are not known living and four are not known in the present fauna of the same region. Or, using the old method of percentages, we find 56% of the fossil fauna in the living fauna. It is found that twenty-

These strata, like the Atlantic Miocene, are characterized by many huge Pectens, large Arcas, and other forms which have no representatives in the present waters of the coast. Thus, there is on the coast of California one very small species of Arca, found at San Diego. In these strata we find great numbers of several species of Arca, some of which are over four inches broad. The most common of these, the *Arca microdonta* Conrad, will fit the figure and description of *Arca arata* Say of the Maryland Miocene just as well as it does Conrad's figure and description of the west coast species. The presence of the large Pectens, six or seven inches across, gives the fauna a strong resemblance to the Atlantic Miocene of Virginia and Maryland. Aside from the above localities, these Pectens have been previously quoted only from strata generally acknowledged to be Miocene. The *Crepidula grandis* Midd. is another form about four times as large as any of its living representatives. The *Cardium meekianum* Gabb, *Saxidomus gibbosus* Gabb, *Mactra* (not *Venus) pajaroensis* Con. and the Echinii, *Scutella Gibbsi* Rem. and *S. interlineata* Stimp. are among those which have no living representatives. A number of others are only known now living in distant seas. In several cases it is found that certain characteristics of a species have changed.

We have seen that there is good evidence that the beds just north of Mussel Rock and those between Point Montara and Pillar Point are the same as those further south at Purissima, etc. The fauna at Point Pillar though small did not give a single form living in the present fauna there, though the lower beds toward Point Montara did; thus seeming to support the structural evidence.

The fauna, while closely related to living faunas, as shown by the percentages given above, is found to have quite a number of species closely resembling species which in eastern America are typical of the Miocene. Two other facts of interest come in here; first, as already pointed out, the evidence of practically continuous sedimentation from the White Miocene shale to the top of the Pliocene or a little beyond; and second, the interesting way in which, as the series is ascended, the older forms drop out one by one. Thus, the large pectens are found only near the very bottom of the series, none of them having been found in the main body of the section as exposed on Seven-Mile Beach. In the same way many of the other species can be traced part way up the column, when they disappear, as the *Crepidula grandis* and large Arcas, thus showing finely a gradual dying out of one fauna and replacement by another.

It would therefore seem that the lowest, or what might be called the Pecten beds, are more closely related to the Miocene, but a rapidly changing fauna soon gives the beds a Pliocene aspect which is maintained through most of the section. The writer has, therefore, thought it best to call the lower beds, as exposed along the coast south of Half Moon Bay and at Capitola, "Transition Beds."

filosa and *Crepidula prærupta* occur only at the bottom of the section, the *Crepidula grandis*, *Arca microdona*, *Cardium meekianum*, *Saxodomus gibbosus*, *Mactra* (not *Venus) pajaroensis* and *Scutella interlineata* disappear at different horizons and are replaced in the uppermost layers by living forms. Thus for example the living *Echinarachinus excentricus* replaces *Scutella interlineata*, *Cardium corbis* replaces *C. meekianum*, from which it probably descended, etc.

The fauna of the main body of the section is as follows:

LIST OF FOSSILS.	Seven-Mile Beach	Twelve-Mile Creek	Foothills	Extinct	Living Elsewhere
GASTEROPODA.					
Astyris gausapata Gould	*	..	..	..	..
Calyptræa filosa Gabb?.	*	..	..	*	..
Chemnitzia tennicula Gould	*	..	..	*	..
Chorus belcheri Hinds?	*	..	..	..	s.
Crepidula grandis Middendorf	*	..	..	*	..
Crepidula prærupta Conrad	*	..	..	*	..
Drillia incisa Carpenter	*	*	*	..	..
Lunatia lewisii Gould	*	..	..	..	..
Nassa californica Conrad. Var	*	*	..	..	?
Nassa fossata Gould	*	..	..	..	..
Neptuneata bulata Baird	*	..	..	..	..
Olivella biplicata Sowerby	*	*	..	..	..
Purpura crispata Chemnitz	*	*	..	..	..
Purpura saxicola Valenciennes	*	..	..	..	..
Turritella sp. ind	*	..	..	?	s.
LAMELLIBRANCHIATA.					
Arca microdonta Conrad	*	*	..	*	..
Cardium meekianum Gabb	*	*	..	*	..
Cardium quadragenarium Conrad	..	..	*	..	s.
Chione succincta Valenciennes	*	..	..	..	s.
Cryptomya californica Conrad	*	..	*?	..	..
Macoma edulis Nuttall?	*	..	..	..	n.

cies in the fossil fauna eighteen in the present fauna of the same region, or 57%.

The southern character of the fauna is very noticeable. Several of the living species are known only in more southern waters, and some of the extinct forms, as the *Arca microdonta* Conrad, are related to forms found only south of this region.

TABLE OF FOSSILS OF UPPERMOST BEDS OF MERCED SERIES.

	Living	Not Represented in Present Fauna	Seven-Mile Beach, Upper Gasteropod Beds	Seven-Mile Beach, above Upper Gasteropod Beds.	Twelve-Mile Creek	Near San Bruno
Astyris gausapata Gould	*		*			*
Bittium armillatum Carpenter	*				*	
Cardium corbis Martyn	*		*	*		
Cardium quadragenarium Conrad?	*	*	*			
Chione succincto Valenciennes	*	*	*			
Columbella richthofeni Gabb		*	*			
Crepidula navicelloides Nuttall	*		*			
Crytomya californica Conrad	*		*			
Drillia incisa Carpenter	*					*
Drillia penicillata Carpenter	*	*	*			
Macoma edulis Nuttall	*	*	*			
Macoma nasuta Conrad	*			*		
Monoceras engonatum Conrad	*		*			
Mytilus edulis Linnæus	*		*	*?		
Nassa californica Conrad, var.			*		*	
Nassa fossata Gould	*		*			
Nassa mendica Gould	*		*	*		
Neptunea recurva Gabb?		*				*
Olivella biplicata Sowerby	*		*		*	*
Olivella intorta Carpenter	*				*	
Ostrea sp. ind	*?		*			
Placunanomia macroschisma Deshayes	*		*			
Psephis lordi Baird	*		*			
Purpura canaliculata Duclos?	*		*			
Purpura crispata Chemnitz	*		*	*		*
Purpura saxicola Valenciennes	*		*			
var. ostrina? Gould	*					
Saxidomus gracilis Gould	*		*	*?		
Schizothœris nuttalli Conrad	*		*			
Standella californica Conrad	*		*			
Tapes staminea Conrad	*		*			
Echinarachinus excentricus Escholtz	*			*		

To sum up, it will be seen that out of thirty-one species that were specifically identified, six are not known to the fauna of this region (from San Francisco to Santa Cruz), leaving twenty-five species known in the present fauna, or 81% of the fossil fauna are living in that region. This by the old method would make the beds Pliocene. But considering the smallness of the fauna and the questionableness of several of the specific identifications, that method can have but little value here. Nor have any satisfactory results been obtained from a comparison with known Pliocene faunas, for the species are all peculiar to the west coast, or are not known in the fossil state elsewhere.

The arguments from the structural side are, that while, as shown by the fauna, this formation is possibly later than Pliocene, it is found to be overlaid by horizontal or nearly horizontal strata containing Elephas bones, with evidence of a land period between. Since these beds were laid down, therefore, there has been a movement which has tilted them at angles of from 5° to 40°, followed by their being exposed to subaerial erosion, and survey; but the beds we are here considering the top of the Pliocene they called "Post-Pliocene." They noted the presence of two extinct forms — *Scutella interlineata* Stimp. and *Crepidula grandis* Midd.— among several species still living on this coast. It was on the finding of these two forms that the main section was judged to be Pliocene. In the upper two beds they found only shells of recent species, among which the genera Tellina, Mytilus and Buccinum are represented. Of these two beds, the lower, according to Mr. Remond, have a northwest strike, and dip to the northeast at an angle of 35°, while the upper ones have an inclination of only 10°. We have already seen that over most of the distance the lower beds really have a dip of from 65° to 75°, and we find that these upper beds have a dip of from 5° to 40°.

Structure and Relations of Uppermost Beds of Merced Series.—The present position of the strata of this formation as exposed along Seven-Mile Beach is shown on the left of plate xxiv. The dip over most of the section is from 20° to 30°, but rises as high as 40°. and at one point was 50°, but was probably local, due to recent movement. At the northern end the strata becomes practically horizontal. Except along the stretch of landslide, the strata have nearly the same strike as the beds underlying, ranging from N. 50° W. to nearly due N.

The contact between the Pliocene and underlying beds is obscured by its occurring just at the south end of the long landslide. A detailed examination failed to reveal any definite evidence in proof of or against nonconformity at this point.

In favor of conformity is—a similarity between certain of the strata lithologically, a similarity in their structure, and the lack of definite proof of nonconformity, which factor must be taken as favorable to conformity.

In favor of nonconformity is the difference in the fauna, several of the extinct forms of the lower beds, as *Scutella interlineata* Stimp., *Crepidula grandis* Midd., *Venus pajaroensis* Con., and others, not occurring in these upper beds. Also differences in the strata, the entire absence in the upper formation of the conglomerates and sandstones which ring when struck with a hammer, and which are abundant to the very top of the lower formation. Slight structural differences, for while the lower beds range in dip from 35° to 78° and over most of the exposure are between 65° and 75° the upper beds will only range from 5° to 30°, though locally rising to 40° and 50° in one or two places. Further, while in some places the strike of the strata is nearly the same, at the point of contact there is a marked change of nearly 90°. The strike which along the landslide is practically the same as the course along the beach, just south becomes nearly at right angles to the beach. This difference may be influenced by but is not due to the landsliding, the change being very marked in the cliff back of the slide. It was found impossible to correlate strata of the upper and lower formations. The manner, for example, in which the up-

	Foothills, above Basalt	Foothills, below Basalt	Coal Mine Canon	Near Searsville	Extinct	Living Elsewhere
Arca microdonta Conrad			*	*	*	
Cardium meekianum Gabb		*	*		*	
Cidaris sp. ind	*				?	?
Crasatella collina Conrad?			*		*	
Crepidula grandis Middendorf			*		*	
Dosina ponderosa Gray	*		*			s.
Glycimeris generosa Gould		*	*			
Lucina borealis Linnæus	*	*				s.n.
Lucina nuttalli Conrad			*			
Lunatia lewisii Gould			*	*		
Macoma nasuta Conrad				*		
Nassa californica Conrad				*		
Neptunea recurva Gabb				*	*	
Pecten islandicus Müller	*	*				n.
Pecten latiauritas Conrad	*	*			?	s.
Saxidomus gibbosus Gabb?				*	*	
Schizothœris nuttalli Conrad				*		
Solen siccarius Gould		*	*			
Standella californica Conrad				*		
Standella planulata Conrad?			*			
Tapes staminea Conrad			*			
Tapes tenerrima Carpenter			*			
Terabratella caurina?	*					
Mactra (not Venus) pajarœnsis Conrad			*		*	
Yoldia impressa Conrad		*				s.

Out of the twenty-five species given seven are extinct, not counting the questionable cases, and six are known living only to the north or south. That is, out of twenty-five fossil species eleven are found in the present fauna of this part of the coast or 44%. The fossils in this area though abundant are very poor, seldom showing sculpture and generally much distorted; the determinations are therefore in many cases somewhat questionable.

Merced Series at San Fernando Pass.—At the San Fernando tunnel in Los Angeles county, the beds that have been considered as Miocene of the Monterey series are overlaid conformably by a series of calcareous sandstones and conglomerates, which are quite fossiliferous. As this series occupies structurally the same position that has been assigned to the Transition beds of the Santa Cruz Mountains it will be of interest to compare their faunas.

Among the fossils collected in the ridge over the San Fernando tunnel the following have been specifically determined:

Amusium caurinum Gould.
Calyptra filosa Gabb?
Cancellaria c. f. vetusta Gabb.
Cardium meekianum Gabb.
Chione simillima Sowerby?
Crepidula rogosa Nuttall?
Dentalium hexagonum Sowerby.
Dosina ponderosa Gray.
Drillia torosa Carpenter.
Lunatia lewisii Gould.
Macoma nasuta Conrad.
Myurella simplex Carpenter
Nassa Californica Conrad.
Neptunea humerosa Gabb.
Ostrea veatchii Gabb.
Pachopoma gibberosum Chemnitz.
Liropecten estrellanum Conrad.
Pisania fortis Carpenter.
Saxidomus gibbosus Gabb?
Solen sicarius Gould.
Turritella cooperi Carpenter.
Turritella jewetti Carpenter.
Venericardia venticosa Gould.

In this list of twenty-three species, fourteen are living in the present fauna of that region or sixty per cent.

Summary.—Based upon the above data the following conclusions seem justified:

A better knowledge of both the fossil and living fauna would unquestionably modify these results, but it is believed that it would not materially alter them. Had all the species collected been identified it is thought the percentages given would be somewhat lower.

The field work done by the writer in Los Angeles county has shown that the Coast Ranges are not all of one age. The Santa Cruz Mountains were certainly elavated at a later date than the mountains of Los Angeles county. The suggestion is made that the parallel ranges of the Central California coast line agree in age with the Santa Cruz Mountains; that the east and west ranges of Santa Barbara county, and to the south, are of one age, having been raised during the Merced Period and near the close of the Miocene. Attention has been called above to the presence at San Fernando of fossiliferous strata conformably above the Monterey series. The fauna of these strata has also been shown to agree closely in its character with the fossiliferous or transitional beds at the bottom of the Merced series. The mountains of that region were evidently raised soon after and *before* the deposition of the uppermost beds of the Merced series in the Santa Cruz Mountains. This is shown by the existence at San Pedro and elsewhere along the coast of horizontal strata, evidently of later age than the neighboring mountains, which contain an abundant fauna, believed to correspond with the fauna of the top of the Merced series in the Santa Cruz Mountains.

THE PLIOCENE OF SAN PEDRO.

The plain of Los Angeles, stretching from the city to the coast, is broken at the harbor of San Pedro by a long hill, 1475 feet high, according to the Coast Survey, known as San Pedro Hill. It is smooth and bare of timber, but interesting, both on account of its terraces, of which about a dozen are recognizable, and on account of certain fossiliferous beds which fringe its base in places. The main body of the hill is composed of the Monterey series, with only gentle dips as far as seen. The dips vary somewhat, but are most common to the southeast. These strata were not fossiliferous where examined, but some pectens were found in one of the fragments in a conglomerate near the lighthouse. These strata were thought by Trask* to be Cretaceous, though he had "some hesitancy in placing these rocks so high up in the geological series." Later Dr. Antisell† correlated them with the bituminous or Monterey group.

The fossiliferous beds on the flanks of the hill were called by Conrad‡ "recent or post-Pliocene." In Dr. Cooper's list of fossils they are referred to as Quaternary.§ In 1874, Dr. W. H. Dall published a list of sixty-nine molluscan forms from a well in San Diego, of which he states,‖ "The age of the deposit, in general terms, may be taken as Pliocene." In 1892, in the correlation paper on the Neocene, he says:¶ "It appears that on Deadman Island, near Point Fermin, at least three disthat basis assigns the middle layer on San Pedro Hill to the Pliocene.*

It is hoped that the few hours spent there while working up this paper will put the geology at that point in a little clearer light and on a more substantial basis, and it is thought that Dr. Dall's conclusions will be substantiated.

Surrounding the hill on the east and north is a very broad terrace, from 20 to 40 feet above tide, most of the town of San Pedro being on this terrace. Near the depot this terrace is still flanked by soft deposits. At the top is a layer, two feet thick, of black sandy soil, containing many *Pecten æquisulcatus* Cpr., *Chione simillima* Sby., and other living shells. This bed will be treated more fully under the Quaternary. Below that bed are three to four feet of dark sand, then another thin layer, which is quite fossiliferous, and is the middle layer referred to above. Below that is a sandy deposit that has all the appearance of sanddune structure. At the entrance to the harbor this lower deposit is cut away and a recent sea-cliff runs out to Point Fermin and around the island. The middle layer or Pliocene is exposed at the top of this cliff lying uncomformably on the disturbed Miocene. At one point, where a short drain has cut into the cliff, the Pliocene layer is especially fossiliferous.

Altogether 125–150 species were collected in this layer, of which number 104 species have been determined specifically.

In the following list of Pliocene fossils collected at San Pedro the first column gives those which have been reported† from the Miocene; the second gives those previously reported from the Pliocene, most of which are from the list of fossils from the San Diego well, which Dall referred to the Pliocene.* The third column notes those previously reported from the Quaternary, but which in reality mostly came from these beds, believed now to be Pliocene, from Santa Barbara, San Pedro and San Diego. The fourth column gives those known to be living, the (o) indicating those which have not been found in the living state. The fifth column indicates those which are not known in the present fauna of San Pedro, but which are known to the north (n) or to the south (s).

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* Univ. of Cal., Bull. Dept. Geol., vol. i, p. 128.

† From Dr. Cooper's list, 7th Ann. Rep. State Mineralogist, 1888, pp. 223 *et seq.*

The last column will be referred to beyond:

NAMES OF FOSSILS.	Miocene	Pliocene	Quaternary	Living	Living Elsewhere	Living on Catalina Is.
GASTEROPODA.						
Acmea mitra Escholtz	..	..	*	*	..	..
Acmea patina Escholtz?	..	..	..	*	..	..
Amphissa corrugata Reeve	..	*	*	*	..	..
Astyris carinata Hinds	..	..	..	*	..	..

NAMES OF FOSSILS.	Miocene	Pliocene	Quaternary	Living	Living Elsewhere	Living on Catalina Is.
Crepidula navicelloides Nuttall		*	*	*		
Crepidula rugosa Nuttall			*	*		
Crucibulum spinosum Sowerby		*	*	*		
Dentalium hexagonum Sowerby		*	*	*		
Drillia c. f. aurantia Carpenter				*		
Drillia torosa Carpenter			*	*	n.	
Fusus robustus Trask?			*	0		
Fusus rugosus Trask?			*	0		
Glyphis aspera Escholtz			*	*		
Hipponyx antiquatus Linnæus			*	*		
Ischnochiton regularis Carpenter				*		
Lacuna solidula Loven			*	*		
Leptonyx sanguineus Linnæus?				*	?	
Lottia gigantea Gray				*	?	
Lunatia lewisii Gould		*	*	*		
Lunatia pallida Broderip and Sowerby		*		*	n.	*
Mangelia variegata Carpenter?			*	*		
Margarita pupilla Gould			*	*	n.	*
Monoceras engonatum Conrad			*	*		
Nacella incessa Hinds				*	?	
Nassa fossata Gould	*	*	*	*		
Nassa mendica Gould		*	*	*		
Nassa perpinguis Hinds	*	*	*	*		
Neverita recluziana Petit	*	*	*	*		
Ocinebra lurida Middendorf		*	*	*		
Ocinebra interfossa Carpenter			*	*		
Odostomia gravida Gould			*	*		
Olivella biplicata Sowerby		*	*	*		
Olivella intorta Carpenter		*	*	*	n.	
Olivella pedroana Conrad		*	*	*		
Pleurotoma perversa Gabb			*	*	n.	*
Priene oregonensis Redfield			*	*	n.	
Purpura crispata Chemnitz		*	*	*	n.	
Ranella californica Hinds				*	?	
Scalaria hindsii Carpenter				*	?	
Surcula carpentariana Gabb		*	*	*		
Thalotia caffea Gabb			*	*	n.	
Thylocodes squamigerus Carpenter				*		
Tornatina cerealis Gould			*	*		
Trochiscus norrisii Sowerby			*	*		
Trophon orpheus Gould		*	*	*	n.	
Turritella cooperi Carpenter		*	*	*		
Turritella jewetti Carpenter		*	*	*	n.	
Turritella variata Conrad	*			0		

NAMES OF FOSSILS.	Miocene	Pliocene............	Quat-rnary............	Living................	Living Elsewhere.....	Living on Catalina Is..
LAMELLIBRANCHIATA.						
Acila castrensis Hinds	*	*	*	*	..	..
Cardium centifilosum Carpenter	*	*	*	*	n.	*
Cardium corbis Martyn	..	..	*	*	n.	..
Cardium procerum Sowerby	..	*	..	*	s.	..
Cardium quadragenarium Conrad	..	*	*	*	..	..
Cryptomya californica Conrad	*	*	*	*	..	..
Donax californicus Conrad	..	..	*	*	..	..
Hinnites giganteus Gray	*	*	*	*	..	..
Liocardium substriatum Conrad	..	..	*	*	..	..
Lucina borealis Linnæus	*	*	*	*	n.	*
Lucina californica Conrad	..	..	*	*	..	..
Lucina nuttalli Conrad	..	..	*	*	..	..
Lutricola alta Conrad	*	*	*	*	..	..
Macoma inquinata Deshayes	..	*	*	*	..	..
Macoma nasuta Conrad	*	*	*	*	..	..
Macoma secta Conrad	..	*	*	*	..	..
Ostrea lurida Carpenter	..	..	*	*	..	..
Pachydesma crassatelloides Conrad	..	..	*	*	..	..
Pecten hastatus Sowerby	*	*	*	*	..	..
Pecten islandicus Müller	..	*	*	*	n.	..
Pecten latiauritus Conrad	..	..	*	*?	..	..
Pecten paucicostatus Carpenter	..	..	*	*	..	..
Pecten ventricosus Sowerby	..				s.	..

In summary, it will be seen that of 104 species identified 99 or 95% are living. But many of these living are only known now in, for example, the Arctic fauna; thus it is found that of the 104 species, 26 have not been reported from San Pedro, leaving 78 species of 104 fossils species known to be living or 75%. Even supposing that a better knowledge of the fauna should reduce by one-half the number not known there at present, we should still have only 87% of the fossil fauna represented in the living. Again notice that of the species which have migrated all but two have gone northward, a number being known only in Arctic waters at present. As indicated in the last column a number of these northern forms are still found on Catalina Island. But as has been shown by Professor Lawson,* Catalina Island did not share in the subsidence of which we have such abundant evidence at San Pedro and all along the coast. Having in mind then that these beds lie on what are apparently wind deposits, and are overlaid by beds whose fauna differ markedly from that of these beds, but agrees very closely with the present fauna of the coast, also that the hill presents evidence of having been almost or completely submerged, we seem justified in drawing the following conclusions:

1st. The deposition of these beds has been followed by a submergence of at least 1200 to 1400 feet, and later has come uplift to the present level.

2d. That there has been a change in the climate from cold to warmer.

3d. That these changes have occupied a long time, as judged by the fact that so few of the migrating forms have become extinct; and by the extent of wave erosion exposed on the hill.

Based on the above, the following suggestion is made:

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* Univ. of Cal., Bull. Dept. Geol., vol. i, p. 138.

that these beds antedate the close of the ice age and may have been deposited early in the Pleistocene, or in the Pliocene.

It is a matter of judgment and precedent as to which of those two periods we shall assign these beds. On account of the distinct character of the fauna, we cannot compare it with known Pliocene areas, and therefore our only resource is to fall back on the old method of percentages and say that as all the beds of known Quaternary age have a higher percentage of forms living in the present fauna, we may conditionally assign these beds to the Pliocene. On the other hand the arctic character of the fauna would suggest that these deposits were laid down during the early part of the Pleistocene in what is known as the Ice age.

It may be of interest to note that the above list as compared with the latest published list of California fossils (1888)* shows thirty-three species not noticed before as fossils at San Pedro, eleven species not previously noticed as fossil and fifty-four not before known as Pliocene, while one species has only been known as Miocene.

of Japan finds similar beds with a similar fauna along that coast, and reasoning partly from the changes and migrations which have taken place in the fauna, and partly on the non-conformities which the beds there show in places with overlying beds, he assigns them to the Pliocene period.

4. THE QUATERNARY.

The Santa Cruz Mountains are fringed around the base with a belt of nearly horizontal deposits. Topographically these extend from the edge of the foothills to sea-level with a very gentle slope. On the ocean side these deposits and the older deposits upon which they rest unconformably have been much eroded by the waves, so that much of the distance the lower part of the slope has been cut away and a vertical cliff is left to mark the advance of wave erosion. See plate xxii. As erosion is strongest at about mean tide level, there are usually numerous reefs exposed at lowest tide. At a few places stacks, sea caves and natural bridges attest the rapidity with which the erosion is progressing. At Point San Pedro erosion has destroyed all trace of this old bench or terrace. The upper edge of this bench, where it meets the mountains or foothills, varies somewhat in height. A study of this variation shows in the case of the Santa Cruz Mountains that it is due to the character of the uplift, that is, the uplift has not been a general vertical rise of so many feet, but has been strongest in the old axes of uplift, the main ridges of the range. The result of this is that the line of contact with the foothills has an elevation inversely proportional to its distance from the lines of uplift. Thus at the Mussel Rock, the terrace is over 220 feet above sea-level.

Quaternary of Mussel Rock.—From Mussel Rock southward the sea has cut a fine section of these beds. The deposits here are at least 150–200 feet thick. At the bottom is a heavy bed of sand having the peculiar structure of sanddunes. This rests upon the surface of the old eruptive rock which makes up Mussel Rock. Above the æolian deposit are marine deposits of sand and gravel to the top of the terrace, the gravel being largely fragments of the old igneous rock. See plate xxv.

In the ravine a short distance south of Mussel Rock, the deposit is a difficult one to understand. Between the wind deposit and igneous rock are several argillaceous sandy layers which are not strictly conformable among themselves, but appear to have been laid down during a comparatively rapid rising of the shore. Over these beds come the wind deposits, and above those the marine deposits of sand and gravel. A short distance south the sand loses its gravel, and, except at a few places where the irregular surface of the igneous rock is exposed above the beach, the deposit continues to be sand to the end of the section at sea level. Near each exposure of igneous rock, the deposit is largely made up of fragments of the rock.

South of Point San Pedro.—Wave erosion has formed bluffs nearly the whole distance from Point Montara to Capitola. The Quaternary forms the top of these bluffs most of the way. Thus, at Purisima we have about thirty feet of horizontal sand and gravel overlying about fifty feet of the upper Miocene, the lower beds dipping to the north. See plate xxiv. The gravel referred to proves upon examination to be fragments of rock exactly similar to the layer of volcanic ash in the Pliocene of Seven-Mile Beach. These fragments of volcanic ash occur abundantly not only in the Quartenary all along the coast from Half Moon Bay to Capitola, but also in the Quaternary deposits in the little valleys opening out toward the Bay of San Francisco. This leads to the suggestion that the layer of volcanic ash on Seven-Mile Beach originally extended all around the mountains, and that these fragments tell what has become of it and explain why the Pliocene is not found over a broader area. These fragments argue strongly for a land period with subaereal erosion between the Pliocene and Quaternary and support the evidence of the sanddunes at Mussel Rock. These fragments of volcanic ash were used to some extent in recognizing the Quaternary.

Fossils are not abundant in the Quaternary along the coast, though at places Haliotis and some other shells are quite plentiful.

At Santa Cruz, besides the lower broad terrace already mentioned, several others are observable. Dr. Lawson* counted nine, the highest one 1201 feet above sea-level. The terraces have their sea-cliffs, from the foot of which the ground slopes gently to the next lower sea-cliff.

Along the Bay of San Francisco.—Along the bay the Quaternary deposits have not been cut by the waves, but form a continuous slope from the foothills to the center of the bay itself. In some areas, as between San Mateo and Coyote Point, the layer forming the surface is a black earth full of commuted fragments of shells. Small areas of apparently similar deposits occur at the surface of the Quaternary near the mouths of nearly all the little valleys which open out upon the main valley of the Bay of San Francisco. Smaller patches of a few acres occur at many points on the flanks of the foothills, sometimes several hundred feet above the bay.

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* Univ. of Cal., Bull. Dept. Geol., vol. i, p. 141.

The most abundant shells among these fragments are:

Cardium corbis Martyn.
Cerithidea californica Haldemann.
Macoma nasuta Conrad.
Mytilus californianus Conrad.
Ostrea lurida Carpenter.

The study of the Quaternary on the side of the mountains toward the bay is not easy, on account of the difficulty of distinguishing between subaerial and marine deposits. Much of the flat land of the valley appears to be of subaerial origin, as shown in cuts made by streams, but this seems to be overlain by bay deposits.

beds upon which they lie. But though so similar in appearance, erosion discloses a marked difference in the solidity of the two formations. In the deposit at the head of Wood's Gulch, already described, the end of a tusk, presumably of elephant or mastodon, was found about 75 feet below the top of the deposit.

Though these deposits for the most part appear to be of fresh water and wind origin, there are some facts that suggest that they are, in part, at least, of marine origin. In some cases the top of the deposit is so little below the elevation of the surrounding land, its area so large, as compared with the area of the hills from which it might derive material, that we are led to suppose, either, that the surrounding points are almost reduced to base level (in this case the top of the deposit), or else that submergence has permitted the deposition of marine deposits. There is one feature that strongly favors the latter theory. Nearly all the streams running to the bay show a marked terrace almost to their head. In most cases the streams have cut down through this terrace, revealing deposits from a few feet to twenty-five or thirty feet in depth. In many cases these cuts are very recent, as traces of wagon roads are still visible at their heads, or are shown upon the U. S. Coast and Geodetic Survey map of 1869. These terraces follow about the present inclination of the stream bed, and, though they can seldom be traced continuously, would appear to join the general level land which slopes from the foothills to the bay. The character of these stream terraces, like the isolated deposits described in the preceding paragraph, is varied. In places they appear to be beyond a doubt subaerial stream deposits, containing trunks of spruce or redwoods, sometimes three or four feet in diameter. The wood in these trees is still in good preservation. Above the trees, which lie horizontally, the strata are suggestive of marine origin, strengthening the evidence presented above of a very recent submergence. Dr. Lawson ascribes to these upper beds a Pliocene age.*

As some question has been raised as to whether these terraces are not the result of erosion rather than of sedimentation, it may be well to call attention to the evidence more in detail. In the first place, these terraces and fillings show only horizontal bedding; further, the bedding of the strata forming the hillsides is in nearly, if not quite, every case where found, more or less highly inclined, and finally, in nearly every ravine one or more contacts were found where the horizontal strata can be clearly seen lying upon the highly inclined strata of the Merced series. A few of these might be mentioned. The formation at the head of Wood's Gulch has already been described. In the ravine which heads up against Wood's Gulch, a few yards below the Old San Pedro-Colma road, the Merced sandstones and thin bedded gravels are well exposed, having an almost perpendicular dip. On the edges of these perpendicular beds lie the recenty st ood for a considerable time at an elevation of 1600 to 2100 feet below its present level.* Evidence of this can be seen in the level summit of the main ridge to the north of Black Mountain.

Standing upon the hills near South San Francisco station where a comprehensive view can be obtained of the line of hills extending from Seven Mile-Beach to Redwood City, between Crystal Springs Valley and the bay, their summits can be seen to present a remarkably even horizontal line. Examined on the ground the top of this line of hills has the aspect of a plateau, from which rise a few sharply conical knobs. These have the appearance of remnants left by the eroding waters which planed off the top of the hills leaving the plateau. Further evidence of such a submergence and erosion is found in the fact that a little further south, where these hills are not separated from the main mountain ridge by the broad and deep valley, their summits are more or less covered with boulders of metamorphic rocks well water worn.

Altogether the evidence seems quite strong to show that the Santa Cruz Mountains have very recently been submerged to a depth near San Francisco Bay of at least 600 feet. In a later uplift the mountains seem to have stood for some time at a level about 100 feet below their present elevation. This has resulted in the marked shore line where the rounded foothills meet the nearly level floor of the valley surrounding the bay. This level floor seems to have been the result partly of erosion and partly of deposition. It seems quite possible that this upward movement is still in progress.

What preceded this recent submergence? The evidence, from two standpoints, would indicate a long land period. The first is the presence of land and fresh water deposits beneath the recent marine deposits and above the upturned and eroded Merced series. The other is the evidence gained from a topographic study of San Francisco Bay and neighborhood. Such a study as recently pointed out by Prof. Lawson* shows the strong resemblance of San Francisco Bay, of Rodeo Lagoon, Tomales Bay, Walker's Creek, Drake's Bay, Bolinas Bay, the valley of Lake Merced, etc., to sunken and submerged valleys.

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* Univ. of Cal., Bull. Dept. Geol., vol. i, pp. 115-160.

The question of the order of the above events is an open one. Prof. Lawson makes the land period followed by a slight submergence the last events. The fact that the marine deposits overlie land deposits has led the writer to place the recent submergence as subsequent to the land period, and in its turn it to precede the still more recent uplift to present conditions.

It is possible that a double movement would explain all the evidence. Aside from the water-worn boulders capping the foothills south of San Francisquito Creek, the marine deposits noticed are confined to the lower levels, about one valleys appearing to have been cut out of the eroded pene-plane; it places the tree trunks found in so many of the ravines, and the mastodon bones in the third period.

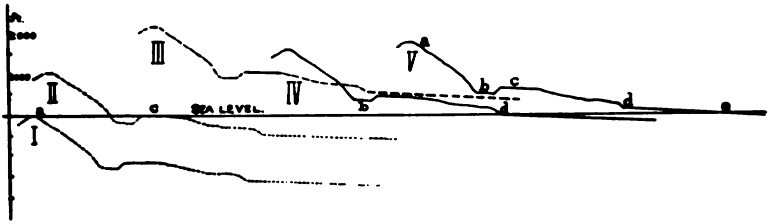

Fig. 1.—Diagram showing movements of the Santa Cruz Mountains during the Quaternary, and the development of the present topographic features. I-V—Successive positions of the mountains. Dotted line—Undeveloped features. Broken line—Partially developed features. Full line—Developed features. a—Main ridge. b—Spring Valley. c—Summit of foot-hills. d—Edge of present valley. e—Shore of San Francisco Bay. NE.-SW. section through Belmont. Vertical scale five times horizontal.

In Los Angeles County.—In the south part of the State the evidence of recent submergence is in many places very striking. As at Santa Cruz, wave cut terraces and sea-cliffs indicate the various levels at which movement has rested and given time for wave erosion. At San Pedro Hill eleven of these terraces have been counted. In the San Fernando Valley nine were counted, and several noticed in San Gabriel Valley. These terraces have been noticed by nearly all the previous writers who visited the coast of Southern California. Prof. Lawson has given us more accurate knowledge of these terraces at a number of localities, and concludes that the movement has been epeirogenic in its character.*

At San Pedro the most recent deposit, that of the lowest terrace, is quite fossiliferous in a few places. It has already been described in the discussion of the Pliocene of San Pedro. The following shells were collected from this layer:

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* Univ. of Cal., Bull. Dept. Geol., vol. i, p. 157.

Bulla nebulosa Gould.
Cerithidea californica Haldemann.
Cerostoma nuttalli Conrad.
Chione simillima Sowerby.
Chione succincta Valenciennes.
Chlorostoma gallina.
Crepidula excavata Broderip.
Haliotis cracherodii Leach.
Liocardium substriatum Conrad.
Ostrea lurida Carpenter.
Pachydesma crassatelloides Conrad.
Pecten æquesulcatus Carpenter.
Schizothœrus nuttalli Conrad.

This fauna is very similar to that on the beach below at the present time.

With the exception of one point no trace of a nonconformity was found between the Pliocene and Quaternary at San Pedro Hill. At one point a V-shaped bed of fine gravel appears in the underlying Pliocene. At first glance it looks like an old stream filling; but examined closely, the edges of the gravel bed are not as sharply defined from the rest of the layer as that theory would seem to require. Though the transition is made in a distance of two or three inches, the two deposits seem to blend along that line as though they were local variations of deposition. The resemblance to a stream cut filling is so strong, however, that the writer believes that a more careful examination is required before we can accept Prof. Lawson's theory of the relation of the Pliocene and metamorphic series is exposed an eruptive rock is very abundant. It is well exposed at Mussel Rock and to the southeast of there, making much of the ridge which runs southeast to San Andreas Lake. Since this paper is concerned chiefly with the Tertiary rocks no attempt was made to map the igneous rock. Its relation to the limestone is shown on the shore at the limestone outcrop in Calera Valley. It is undoubtedly younger. On the east side of San Andreas Lake small exposures show it to be also younger than the phthanites and metamorphic sandstone. It is thus suggested that it may be contemparaneous with the post-Jurassic upheaval.

Serpentines.—The abundance and location of the serpentine has been described. The question of its origin remains unanswered. Owing to the interest which has attached to that question the writer gave to the subject some study, but beyond coming to the belief that the bronzite rock so abundant here represents an older form of the serpentine, the serpentine being, according to that theory, simply an alteration product of the old basic eruptive, he has left the problem where he found it. See Dr. Charles Palashe's paper on "The Lherzolite-Serpentine and Associated Rocks of the Potrero, San Francisco."*

Merced Eruptives.—West and south of Stanford University a large sheet of andesite is exposed. It extends from San Francisquito Creek over the foothills nearest the Bay to beyond the Page Mill Road, which runs up Matadero Creek. At its most northern exposure near San Francisquito Creek it is charactized by columnar structure, the columns being vertical where best exposed, the sheet of andesite being horizontal at that point.

On the Page Mill Road it appears to have been cut by later dykes. These dykes, however, preceded the deposition of the overlying calcareous beds. At the same point an old shore line shows finely, with its Pholas borings, its beach strewn with rolled fragments from the cliff of andesite, and the overlying deposit consisting almost entirely of fragments of barnacles.

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*Univ. of Cal., Bull. Dept. Geol., vol. i, No. 5.

The rock under the andesite appears somewhat metamorphosed. From fossils collected from above and below the andesite its age is evidently in the Merced period as that has been defined in this paper. The fossils do not show any marked change in the fauna and seem to indicate that the outflow took place during the Merced and not at the end.

Other late eruptives require further study before being reported upon.

PALEONTOLOGY.

Distribution.

The Californian Province.— In the present faunas the California province, extending from the Straits of Fuca to Cape San Lucas at the southern end of Lower California, is a well marked province. The provinces north and south overlap to some extent, but taken as a whole the North Atlantic, but are not known living in the Pacific.

Many species are found in Japan and Kamtschatka, which are common on the west coast of North America. Among these may be mentioned: *Amusium caurinum* Gld., *Cardium corbis* Mart., *Crepidula aculeata* Gmel., *Chrysodomus carinatus* Dunker, *Cryptochiton stelleri* Midd., *Glycimeris generosa* Gld., *Laqueus Californicus* Koch., *Leptolhyra sanguinea* Cpr., *Lima dehiscens* Con., *Lucina borealis* Linn., *Siliqua patula* Dixon, *Macoma edulis* Nutt., *M. secta* Con., *M. nasuta* Con., *Mytilus edulis* Linn., *Natica clausa* Brod. & Sby., *Placunanomia macrochisma* Desh., *Priene oregonensis* Redf., *Saxidomus nuttalli* Con., *Siphonalia kelletii* Fbs., *Solen siccariens* Gld., *Tellina bodegensis* Hds.

Local Divisions.—On the coast of California the distribution of species, so far as known, suggests several local divisions of the California province. One extending from San Diego to Santa Barbara county. From a list of the Mollusca of Santa Barbara county, by Dr. S. G. Yates,* it is found that Santa Barbara county is the northern limit of about seventy species, aside from the strictly local fauna. It is also the southern limit of about sixty species. It is next found that the Bay of Monterey marks the northern limit of a large number of species, and suggests a division extending from the Bay of Monterey to Santa Barbara county. It is probable that Santa Catalina Island should be included in this division as well as the Santa Barbara Islands.

From the Bay of Monterey to Bodega Bay seems to mark another division, but the nothern limit may be such simply because of lack of observations further north. Little data is at hand on the faunas between Bodega Bay and Washington.

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* Bull. Sta. Barbara Soc. Nat. Hist., vol. i, No. 2, p. 37.

Santa Catalina Island.—Prof. Lawson * has called attention to the fact, that Santa Catalina Island did not apparently share in the Quaternary subsidence. The fauna of this island presents some interesting features, which would seem to confirm Prof. Lawson's deduction.

Thus, by a study of Dr. Cooper's List of California Fossils, 1888, we find five otherwise extinct species from the Pliocene and Quaternary of Santa Barbara, San Pedro and San Diego are living on the island: *Amycla undata* Carpenter, *Daphuella clathrata* Gabb, *Nassa insculpta* Carpenter, *Psephis salmonea* Carpenter, *Solärellia peramabilis* Carpenter. There are also found living on the island and fossil on the coast of the mainland one species, *Crytodon flexuosus* Montagn, only known elsewhere in the North Atlantic; one, *Lucina borealis* Linneas, known elsewhere only in Arctic waters; one, *Laqueus californicus* Koch, known elsewhere only in the North Pacific. In addition to these, thirteen species, *Bittium asperum* Gabb, *Callista newcombiana* Gabb, *Cardium centifilosum* Carpenter, *Chrysodomus tabulatus* Baird, *Diala acuta* Carpenter, *Leptothyra bacula* Carpenter, *Lucina trunis-*

southern forms. It thus resembles quite strongly the fauna studied at San Pedro and called in this paper Pliocene.

This case is interesting, not alone from showing that the fauna considered Pliocene on the coast of the mainland is still living on or about the island, but from the way the fauna supports the deductions made from the topography and vice versa.

Quaternary faunas.—The faunas of the beds recognized as Quaternary are so similar to existing faunas that what has been said about the present distribution of species along the coast will hold for the Quaternary species.

Pliocene faunas.—The Pliocene faunas bear quite a striking resemblance to the existing forms of the same region, except that there are present a large number of northern forms with some forms which have since become extinct. Until the Pliocene has been differentiated at Santa Barbara, San Diego and intermediate points, as the writer believes they will be ere long, it will be unsafe to generalize on the local distribution of species.

Miocene fauna.—The Miocene fauna, while showing some regional relation to existing faunas, is principally distinguished by its uniformity over the State and its southern character.

Climatic changes.—The facts given indicate that during Miocene times a tropical or subtropical climate existed in California. This is followed by a colder climate and the introduction of boreal forms of life. The end of the Ice age, presumably, brings a return of warmer conditions and the northern forms return to the North Pacific, some species suffering extinction under the changed conditions.

The question arises whether the species found in the Pliocene of California, which are at present living in the North Atlantic, have migrated from the Pacific, or whether they represent southward migrations in both oceans at a time preceding the Ice age. From the occurrence of many of the Pliocene forms of California in the British Crag (Pliocene), it would seem that their distribution is due primarily to pre-glacial migrations.

A comparison of these results with those obtained by a study of fossil vertebrates of California would seem to show a disagreement. Thus Dr. Cooper concludes from the finding of a large species of lion, a llama, a third larger than the living camels, also one smaller, a Megalomeryx, another of the camel family, a Protohippus, etc., which have been thought to have been of Pliocene age, that the Pliocene of California had a tropical climate.* Were the Pliocene age of the deposits from which these fossils were obtained determined beyond question, the disagreement would be vital, and the beds described in this paper as Pliocene would probably have to be considered post-Pliocene.

In the first place, if the deduction upon the age of the lower beds of the Merced series made in this paper is correct, it seems probable that many other beds in the State which have been considered Pliocene may prove to

Another argument of little value, but suggestive, is the possible contemporaneity of the basaltic outflow near the top of the Miocene in the Santa Cruz Mountains with some of the volcanic outflows in the northern and eastern part of the State. Several of the Pliocene vertebrates are described as from under the lava.

There seems to be some ground, therefore, for suspecting that many, if not all, of these tropical vertebrates may ultimately prove to be of Miocene age.

RELATIONS BETWEEN LIVING AND TERTIARY FAUNAS.

Notwithstanding all the evidence of repeated earth movements and climatic changes, molluscan forms have been very persistent in the California Tertiary and Quaternary. In Dr. Cooper's list of California fossils of 1888, thirty-two species are quoted as running from the Miocene to the present, and the determinations of this paper have largely increased that number by making many species Miocene which had previously been thought to go back not farther than the Pliocene. In the same list 118 species are reported from the Pliocene to the present; this also would be largely increased by recent data. From the same source 331 are quoted as found in the Quaternary and living.

If to these figures be added the species which range from the Miocene to the Pliocene or to the Quaternary and those ranging from the Pliocene through the Quaternary, it will be evident that the dividing of the Tertiary and post-Tertiary strata into zones or minor groups will be a difficult, if not impossible, work from the paleontological standpoint. It is probably that fact more than any other that has kept the Tertiary stratigraphy so long in confusion.

Changes in species.—One of the most interesting features of the study of the paleontology of the Tertiary and post-Tertiary of California is in studying the changes which have taken place in species which did not migrate, or in tracing the relation between living and old or extinct species of the same type. Lack of time and lack of material have prevented studying this subject as the writer had hoped to do. The few notes given are those taken down in determining the fossils. These notes will be given under the descriptive paleontology, but a few instances of such changes are noted at this point.

Thus, *Cardium corbis* Martyn and *Cardium meekianum* Gabb, appear to grade into each other in such a way as to suggest that *C. corbis* is simply the living representative of *C. meekianum*, no break coming between them. In the Pliocene at San Pedro is a *Chlorostoma* which agrees perfectly with *C. funebrale* A. Adams, except that the last coil is sculptured with a number of strong revolving ribs, the recent species usually having only two, the anterior one rather faint, and a few obsolete ribs. A large number of recent and fossil forms were examined without showing any intermediate specimens.

SUMMARY.

The salient points of this paper are:

1. The description of the conglomerate and sandstone formation underlying the Monterey series.

2. The description of transition beds between the Monterey and Merced series.

3. Fixing the ages of the Merced and Post-Merced uplifts in southern and northern California.

4. Outlining the Quaternary history of the region about San Francisco Bay.

5. Studies in the Neocene changes in the faunal geography of the California coast.

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CHANGES IN FAUNA AND FLORA OF CALIFORNIA.—ON THE POWER OF ADAPTATION IN INSECTS.

BY H. H. BEHR.

The power of adaptation to new circumstances plays a most prominent part in the changes that take place in the fauna and flora of newly settled countries.

It is chiefly the want of this power that causes the disappearance of types which were characteristic to districts before the harmony of organic life was disturbed by the interference of man.

To illustrate the disappearance of such characteristic features, it is only necessary to mention two instances, which all old inhabitants will confirm as soon as their attention is directed to them.

Up to the year 1856 a considerable part of the neighborhood of San Francisco was covered by a chaparral consisting almost exclusively of *Ceanothus thyrsiflorus*. Part of this formerly impenetrable thicket has been removed by human agency, and to a great extent has been replanted by our California *Cupressus macrocarpa*, *Pinus insignis*, Australian Acaciæ and Eucalypti. The more produced by a graceful waterfern, the *Azolla Caroliniana*, that covered the water now monopolized by the luxuriant but coarse weed—the Cotula.

In both instances it was not so much direct interference that changed the character of the vegetation, but a certain inability of the native vegetation to conform to altered conditions of things.

There is a series of phenomena in the complex system of changes that follows the occupation of new territories which practically as well as theoretically is of great importance. It is a series of changes that gradually establish themselves in the relations between the vegetable kingdom and the insect world.

In new countries we find a certain harmony in these relations. Undisturbed nature characterizes itself by a greater variety of species than those exhibited in the agricultural stage, when the battle for existence has begun to thin out the original inhabitants of the soil. Another peculiarity of this undisturbed state is a certain equilibrium in the number of individuals of the different species, amongst whom there is no preponderation of species, otherwise than a very rare and even then a very transitory one.

The exclusive cultivation of agricultural plants and domestic animals proves a first cause of long series of effects, of complications, modifying each other. For instance, the planting of extensive orchards has favored an increase of those insect species that live on different varieties of fruit trees, and that formerly had a more or less precarious existence on wild species of the same order, mixed up with a forest vegetation of orders that do not favor the multiplication of insect species, depending exclusively on species related to certain fruit trees.

This, of course, is changed after some time, when such fruit trees are grown to the exclusion of other species, forming, so to say, a forest of their own.

We will at present refer to a single group of insects, the Coccides, and especially the species of Lecanium and its allied genera, which in common life are comprised under the name "scalebug." All these insects produce a sticky exudation, which partly hardens into the protecting scale from which the group received its vernacular name, partly it covers leaf and branch in form of a kind of viscosity.

This viscosity again retains the spores of minute parasitic fungi of different varieties, one of the most common forms being the Capnodium, and we soon will observe a sootlike substance covering many leaves in our orchards as a concomitant of the scalebug. Under ordinary circumstances but few spores out of a million reach their destination, that is a spot favorable to their development. But with the facilities offered by the sticky surface of leaves that are infested by the scalebug and the numbers of individuals that have already developed and have matured their spores, the number of germs floating in the to attack afterwards, in their Puccinia stage, grass and cereals; Rhytisma and Dædalea spores carried in the feathers of birds will be carried from tree to tree and by a slow but sure process will kill the giants of the forest. This is one of the causes that but seldom you find a healthy Madroña tree in the neighborhood of cultivated land and that the Sycamores at Niles Station are dying away.

Up to this point it is easy enough to classify the phenomena and derive them from a common source, but further on the effects become modified by the consequences of other changes that have taken place in the relation of the different forms of organic life. The agency still exists and marches on although we loose sight of the Ariadne thread, which we followed into the labyrinth of co-operating and antagonistic causes. We soon loose sight of the wave of the streamlet after its having joined the waters of the river bed.

The circumstances mentioned here form only part of a general system of changes that have taken place in organic life since the settlement of this country.

One of the most remarkable features of these changes is the degree of ability in the different species that form part of our flora and fauna to adapt themselves to altered circumstances, and the methods by which they adapt themselves.

We will consider here a few cases that were easy to follow up:

1. *Danais Plexippus*, a butterfly, common nearly through this whole continent and lately emigrated into the Sandwich Islands, New Zealand and Queensland. The insect was rare in the vicinity of San Francisco up to the year 1856, when suddenly a great number of this showy butterfly appeared in the streets of San Francisco. The caterpillar feeds exclusively on different Asclepiadace-

ous plants (called milkweed), which type does not grow on this side of the bay. In the following year I found a great number of the larva on *Asclepias fascicularis* growing on marshy grounds near Brooklyn, then called San Antonio. Some years afterwards I found the caterpillar in a garden in San Francisco on an exotic plant of the Asclepias family, *Gomphocarpus Curassavicus.*

From that time the butterfly has visited our streets every fall, and swarms of this insect working against the western current of air, peculiar to our summer months, fly out to the lighthouse, where they disappear, probably drowned in the ocean.

Since the year 1880 they have not visited the city, which omission easily could be accounted for by the circumstance that the marsh where their food plant, the Asclepias formerly grew, was converted into fields and orchards.

In this instance the insect has but little power of adaptation to new food, because it has shown itself dependent upon plants of the milkweed family and became locally extinct, at least temporarily in a district where the ground

In regard to food the larva prefers thistles, but will feed on all other Compositæ, Malvaceæ and Urticaceæ, in our Golden Gate Park even on Lupinus. It conforms to most climates and very different circumstances. It has a single generation in Lapland and I have counted five generations in California. With all this the insect is less common in California than its near relation,

3. *Pyrameis Carye*, which is the most common of the series, but seems to be restricted to our coast as the Chilean specimens that I have seen, exhibit constant and well marked differences. The larva proves the same power of adaptation as its congener by feeding on Urticaceæ, Malvaceæ, Compositæ, etc., but its limited geographical distribution speaks against a facility of the species to adapt itself to changed climatic circumstances or inconveniences of travel.

4. *Pyrameis Hunteri* or *Virginiensis* feeds in California exclusively on Compositæ. It is here the rarest of the three congeners, but is common in the Atlantic States from where it extends as far as Buenos Ayres. So its adaptive power to new food plants is less than that to climatic changes.

In general the power of adaptation is greater amongst the Heterocera than amongst the Rhopalocera, of which several species have been lost to our neighborhood by ploughing or building of grounds formerly grown over by *Lupinus Chamissonis*.

On the other hand one of the East India silkworms, *Saturnia Cynthia*, has shown great adaptation powers in its conforming itself to different climates and no power whatever in adapting itself to a new variety of food. The insect has escaped from zoological gardens and experimental stations and established itself in different countries like an indigenous species, but, as far as I could ascertain, it feeds exclusively on *Ailanthus glandulosa*, which by some strange coincidence has been introduced as an ornamental tree into America and into Europe. Without this coincidence the insect would have perished for want of food in its larva state and would not have derived any advantage from its adaptability to different climates.

Deilephila lineata possesses the advantage of easy adaptation to climate and to food, combined with the enormous power of locomotion peculiar to its class. It is generally considered indigenous to the old and the new world, but as its organization excludes it entirely from the circumpolar regions it is evident that there must exist another center from which the species has spread. The insect is considerably more common im America than in Europe. Our specimens are larger and show their greater vitality by their power of adaptation in the larva state.

I infer from these circumstances that the original center from which this showy species spread is on our continent and not in Europe, where the species is comparatively rare, when on our continent it has occasionally developed into what was supposed to be an insect pest, but owing to company with the larva of *Chœrocampa Achæmon*, the grapevine. In regard to the latter circumstance, I have to take the part of the Deilephila larva, as much more mischief is done by the Chœrocampa, which feeds exclusively on the grapevine, when Deilephila generally prefers the weeds of the vineyard.

The caterpillar is frequently mistaken for the army-worm, which term is correctly applied to the larvæ of different Agrotides, which are much smaller but considerably more dangerous than the formidably looking Deilephila, whose devastations are exceedingly transitory.

The Indians eat the caterpillar, and that to my opinion is another proof of its American birthright, as all savages avoid eating animals which they do not know for generations.

I have here to mention another insect, which, originally very rare, gradually has developed into an insect pest, without possessing any advantages in regard to locomotion, nor powers for adaptation in regard to food or climate.

It is *Phryganidia Californica*, a type most interesting to the student of systematic entomology, but without any attraction as to beauty.

This insect feeds on oaks, formerly exclusively on live-oaks, but since these oaks have diminished in number, in proportion to the insect having multiplied the larva has begun to invade *lobata* and *Kelloggii*, but there its power of adaptation to new food stops.

I do not know how many generations in a year are produced by the insect. I have counted four, but am certain there is at least one more.

In consequence of these many generations the destruction of leaves extends over the whole year, and the poor tree has scarcely produced a new crop of leaves, when it is stripped again by a new generation, so that many liveoaks in our surroundings die by exhaustion.

Phryganidia Californica was formerly very rare, and it was not before the year 1859 that I could add the female to my collection. But from that year the Phryganidia constantly has gained ground, which circumstance has to be accounted for chiefly by the decrease in the number of insect-feeding birds. The group of the warblers (Muscicapa) was formerly well represented on the peninsula and around the bay, but at present most species of these birds have become very rare, some of them being entirely lost to our neighborhood.

Wherever the small bird is protected, as for instance in the Golden Gate Park, the liveoak is free from the Phryganidia and grows well, only being plagued by fungoid growths like the Capnodium, where the groves by too dense growth shut out air and light.

The introduction of the English sparrow has made matters worse, because the sparrow is himself a very poor insect-feeder, but, by pugnaciousness and a certain social organization of his own, he manages to drive away the

THE FISHES OF SINALOA.*

BY DAVID STARR JORDAN,

Assisted by

EDWIN CHAPIN STARKS, GEORGE BLISS CULVER AND THOMAS MARION WILLIAMS.

[With Plates xxvi-lv.]

The Mexican State of Sinaloa lies along the east shore of the Gulf of California, mostly to the north of the Tropic of Cancer, extending from Rio Fuerte on the north, which separates it from Sonora, to the northwest boundary of Jalisco. The greatest length of the State along the coast is about 325 miles. The land forms an irregular and broken slope from the high table-lands and cliffs of the Sierra Madre on the east downward to the coast. Down this slope flow several streams of clear water, which acquire great volume in the rainy season (June to November) and which dwindle rapidly in the dry season of the winter. The coast line is very irregular, being formed of rocky islands, mostly of volcanic origin, and of abrupt cliffs or "rincones," the terminations of hills or spurs from the Sierra Madre. Between these are long curved sand beaches, and occasionally sand-spits across the mouth of some estuary which is thus converted into a lagoon. The water of the sea off the coast is very clear. The bottom is very irregular, as is the contour of the shore.

The chief port of Sinaloa is Mazatlan. This city of about 20,000 inhabitants lies on a peninsula between the Estuary or Astillero de Mazatlan on the south and a curving bay known as the Puerto Viejo on the north. On this peninsula are two considerable headlands, Nevería on the north and Vijía on the southwest, between which is a sand beach, facing the west, noted for its high surf, for which it is named las Olas Altas. North of Puerto Viejo, at a distance of about seven miles, are three large rocky islands, very much alike, close together and in a right line, known as the three Venados. Opposite them on the shore is a similar headland, Camarron. About all these headlands and islands are many rock-pools and basins left filled with water by receding tides. Beyond the extremity of Vijía is a tall conical island, over 500 feet in height, known as Creston. This is surmounted by a lighthouse and is the most conspicuous land mark of the harbor of Mazatlan. North of Creston lie a number of large barren rocks of white volcanic rock, known collectively as Islas Blancas. The scanty harbor of Mazatlan lies to the south of Vijía and Creston, between these and the Isla de los Chivos and Isla de las Piedras. It ends in a long deep winding channel, known as the Astillero or Estuary, which extends around the south side of the city, with many muddy arms lined with Mangrove bushes, then turns to the south, forming for some ten miles the narrow channel between Isla de las Piedras and the mainland. No fresh waters of importance flow into the Astillero and the tides form strong currents as the

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* Contributions to Biology from the Hopkins Seaside Laboratory of the Leland Stanford Jr. University. No. 1.

Mr. Gilbert spent six weeks at Mazatlan where he secured a collection of about 180 species, of which number about fifty were new to science. These were described by Jordan and Gilbert in the Proceedings of the U. S. National Museum in 1881, the typical specimens being deposited in the Museum at Washington. Previous to this time a number of specimens had been sent, by collectors who had visited Mazatlan and Altata, to the Museum at Vienna, where they were described by Dr. Franz Steindachner, and to Berlin where they were recorded by Professor Peters.

Subsequent to the visit of Dr. Gilbert, collections were made at Mazatlan and Presidio by Mr. Alphonse Forrer, now of Santa Cruz, California. Most of these were sent to the U. S. National Museum, where they were described by the present writer. A few specimens were also sent to the British Museum.

In December, 1894, through the kindly interest of Mr. Timothy Hopkins of Menlo Park, California, and under the auspices of the Hopkins Seaside Laboratory, a branch of the Leland Stanford Jr. University, an expedition was sent to Mazatlan for the purpose of collecting fishes. This was in charge of David S. Jordan, assisted by George B. Culver and Edwin C. Starks. In addition, Mr. Thomas M. Williams, Mr. Norman B. Scofield and Mr. James A. Richardson accompanied the expedition as volunteer assistants, with Frank H. Lamb as botanist, and Mr. George B. Seward as herpetologist.

One month, Dec. 24, 1894 to Jan. 25, 1895, was spent at Mazatlan in the collection of fishes. One hundred and eighty-five species were obtained, of which twenty-nine seem to be new to science, besides two species from La Paz. A full series of the specimens obtained is in the Museum of Leland Stanford Jr. University. Other series nearly complete have been sent to the British Museum and to the Museums at Vienna and Berlin. Partial sets are in the Academy of Sciences at San Francisco and in the U. S. National Museum. It is evident that the list here given is by no means a complete record of the fishes of Sinaloa. Doubtless all the species enumerated from Sonora by Gilbert, Jenkins and Evermann, and by Gilbert and others from Lower California, will ultimately be found in this region. Every day spent at Mazatlan either by Dr. Gilbert or by ourselves brought some addition to the list, and the deep water fishes have not been studied at all.

Besides our obligations to Mr. Hopkins, and to the volunteer assistants above named, the writers wish to express their especial indebtedness for local assistance to Dr. George Warren Rogers, a scholarly physician resident at Mazatlan; to Señor Ygnacio Moreno, the leading fisherman of the port, whose efforts in aiding our work were unwearying. We also owe many favors to Messrs. William W. Felton, Bert L. Smith, John L. Kendall and J. Rippey, American residents in Mazatlan. From Dr. Charles H. Gilbert, in whose laboratory the present paper has been

Galeichthys gilberti Jordan & Williams. 1666, 1667, 1668.
Galeichthys azureus Jordan & Williams. 1575.
Stolephorus scofieldi Jordan & Culver. 2941.
Pœcilia presidionis Jordan & Culver. 2687.
Siphostoma starksii Jordan & Culver. 2686.
Mugil hospes Jordan & Culver. 2890, 2954, 1695.
Thyrina evermanni Jordan & Culver. 2688.
Thyrina crystallina Jordan & Culver. 2685.
Scomberomorus sinaloæ Jordan & Starks. 1720.
Caranx medusicola Jordan & Starks. 2645.
Hynnis hopkinsi Jordan & Starks. 1563.
Trachinotus paloma Jordan & Starks. 2690.
Trachinotus culveri Jordan & Starks. 2691.
Mycteroperca venadorum Jordan & Starks. (British Museum.)
Mycteroperca boulengeri Jordan & Starks. 1621.
Lythrulon opalescens Jordan & Starks. 2963.
Microspathodon azurissimus Jordan & Starks. 1636, 2895, 1610.
Teuthis crestonis Jordan & Starks. 2899.
Balistes naufragium Jordan & Starks. 1656.
Aboma etheostoma Jordan & Starks.
Gobius manglicola Jordan & Starks. 3095.
Scorpæna mystes Jordan & Starks. 1616, 1617, 2919, 1501.
Symphurus williamsi Jordan & Culver. 2943.
Orthopristis reddingi Jordan & Richardson.
Alexurus armiger Jordan & Richardson.

Family GINGLYMOSTOMIDÆ.

1. **Ginglymostoma cirratum** (Gmelin.) GATA.

Two large specimens, respectively five and six feet in length, were taken. These agree fairly with published descriptions, except that the black spots scattered over the body are very small and pepper-like. It is possible that these spots vanish with age, and that *Ginglymostoma fulvum* Poey, the unspotted form, is the adult of the other.

This species was obtained by Dr. Gilbert, at Mazatlan and Panama.

Family GALEIDÆ.

2. **Galeus lunulatus** (Jordan & Gilbert). GATO.

Rather common at Mazatlan, where the original types were obtained by Dr. Gilbert.

3. **Galeocerdo tigrinus** Müller & Henle.

Recorded by Dr. Gilbert, from Mazatlan and from San José de Guatemala; not seen by us. It has not been compared with the Brazilian type of the species.

4. **Scoliodon longurio** (Jordan & Gilbert).

Rather common in the harbor at Mazatlan, where the original types were taken by Dr. Gilbert, who also found the species at Panama.

5. **Carcharhinus æthalorus** Jordan & Gilbert.

Original described from Mazatlan; not seen by us. Also recorded by Dr. Gilbert, from Panama. It is not likely that *Carcharhinus limbatus* occurs on the Pacific Coast. Probably this related species has been mistaken for it.

Family SPHYRNIDÆ.

8. **Sphyrna tiburo** (Linnæus). CORNUDA.

One specimen obtained by us at Mazatlan. It was not secured by Dr. Gilbert; this being the first record on the Pacific Coast of America of this common Atlantic species. Our specimen seems to agree fully with an example from Florida.

9. **Sphyrna tudes** (Cuvier). CORNUDA.

Not rare at Mazatlan, where specimens were obtained by Dr. Gilbert, and one by the Hopkins expedition.

10. **Sphyrna zygæna** Linnæus. CORNUDA.

Common in the sea about Mazatlan. Three young specimens taken by us. Also recorded by Dr. Gilbert from Mazatlan and Panama.

Family PRISTIDIDÆ.

11. **Pristis zephyreus** Jordan & Starks n. sp. PEZ DE ESPADA.

Snout to nostrils, 3 in length to base of caudal; breadth of saw at anterior end between first two pairs of teeth half breadth of its base behind the last pairs; teeth on saw trenchant behind, arranged in 22 pairs; hinder teeth wide apart, the interspaces 5 times their base; posterior teeth turned slightly backward, a groove on their posterior edge; front teeth not quite half as long as the saw is broad at their base; distance between first and second tooth three times base of first. (Other specimens examined for us by Dr. G. W. Rogers show 18 to 21 pairs of teeth.) Eye equal to spiracle, contained 3 times in base of saw just behind last pair of teeth; width of mouth a little greater than base of saw; mouth with about 65 series of blunt teeth; slant height of pectoral in front, a little more than half distance from tip of snout to mouth. Dorsals sub-equal; first dorsal inserted in advance of ventrals; about half its base over ventrals; caudal, with a lower lobe, which is equal to slant height of pectoral; tail with a keel on side.

Color, plain olive grey above, light below.

Measurements—Length, 50 inches; caudal, 7 inches; pectoral, 7 inches; dorsal front, 5½ inches; snout without nostril, 11 inches.

Type—A skin in L. S. Jr. Univ. Museum.

Common in brackish waters at the mouth of the Rio Presidio, where one fine specimen was obtained. The species is also recorded (as *Pristis perroteti*) by Dr. Gilbert from Mazatlan, and by Dr. Günther from Chiapam. Dr. Günther identifies this species with *Pristis perroteti* described by Müller & Henle, from the Senegal River. In view of the great difference in the fauna of the Gulf of California from that of Equatorial Africa, this identification may be questioned, especially as there are several details in which the description of *Pristis perotteti* differs from our fish.

We append the description of Müller & Henle, as also

genähert. Die Distanz zwischen den beiden letzten ist nicht ganz 3 Mal so breit als die Basis des Zahns. Alle Zähne nur wenig nach hinten geneigt.

“ Die obere Nasenklappe reicht mit ihrem innern Rande bis zum innern Nasenwinkel. Die Zahne sind grösser als bei Pristis antiquorum, 60–70 in einer Reihe.

Flossen. Die Brustflossen vom Kopf scharf abgesetzt. Erste Rückenflosse mit der Hälfte ikrer Basis vor den Bauchflossen. Schwanzflosse mit kurzem aber deutlichem untern Lappen.

Farbe. Farbe wie *Pristis antiquorum*.

Maasse.

Von der Spitze der Sage zur Mitte zwischen den “aussern Naswinkeln	11″	6‴
Von den Naslöchern zum Maul	1″	10‴
Vom Maul zum After	11″	
Vom After zur Schwanzflosse	8″	
Länge der Schwanzflosse	5″	6‴
Breite der Säge in der Mitte	1″	2‴
Länge des Längsten Zahns		6‴
Breite desselben		1¼‴
Distanz der Naslöcher	2″	
Breite des Maules	2″	

Fundort. Aus dem Senegal. Soll nur im süssen Wasser leben. Ein Exampler ʒ trocken in Paris durch Perottet.”

(Müller & Henle, Plagiostomen, p. 108.)

From the work of Latham we take the following description of his

“ Pristis antiquorum:

Pr. rostro spinis validis utrinque 18–24. Tab. 26, f. i.

Squalus pristis, Lin. Syst. Nat. I., p. 401, 15. Faun. Suec. 297. Mus. Ad Fr. I., p. 52. Mull. Lin. Th. 3, Tab. ii, f. 2 (spin. 18). Gmel. Lin. I., p. 1494, 15. Fab. Fn. Groenl., 130, 91, Mull. Prodr., p. 38, 319. Klein. Miss. Pisc. 3, p. 12, No. ii, tab. 3, f. 1, 2. (pullus.)

Plin. Nat. Hist., lib. 9, cap. 2. Clus. Ex., tab. 14, p. 136 (spin. 20). Aldrov. Cet., p. 692. Will. Icth., p. 61, Tab. B. 9, fig. 5 (fig. Clusii). Raii, Syn. Pisc., p. 23. Olear. Mus., p. 41, t. 26, f. i. Rondel. Pisc. 487.

Bell. de Aq., t. in p. 66 (Langue de Serpent).

Valent. Amboin, p. 33, t. 19, f. 52. Bloch, Fisch. Deutsch., p. 37, t. 120. Du Tertre Ant., p. 207 (Spadon). Bonann. Mus. Kirch., t. 288, t. 21. Cabinet de Ste. Genev., t. p. 100. Brouss. Act. Par. 1780, p. 671. (La Scie.) Pis. Ind. Occ., p. 51. Marcgr. Bras., p. 158 (Araguagua). Gronov. Zooph., p. 33. Arted. Syn. 66, Id. Syn. 93. Brown. Jam. 458, I.

HABITAT IN OCEANO.

"Totum corpus ad 15 pedes longum, supra nigricans, seu leucophæogriseum, abdomine albicante. Caput antice planum. Rostrum ad 5 pedes longum, spinis validis numero utrinque 18–24. Os dentibus granulatis instructum. Oculi magni iride aurea. Pone oculos foramina duo oblonga. Spiracula quinque. Pinna dorsalis prima ventralibus opposita, altera inter primam & caudæ apicem media. Pectorales latæ longæque. Caudalis brevior quam congeribus.

This species and the following grow to the largest size of any which have yet come under the inspection of the naturalist, some specimens measuring 15 feet in length.

The head is rather flat at top, the eyes large, with yellow irides, behind which is a hole, which some have supposed may lead to an organ of hearing.*

The mouth is well furnished with teeth, but they are blunt, serving rather to bruise its prey than to divide it by cutting. Before the mouth are two other foramina, supposed to be the nostrils. The rostrum, beak or snout, is in general about one-third of the total length of the fish, and contains in some eighteen, in others as far as twenty-three or twenty-four spines on each side; these are very stout, much thicker at the back part, and channelled, inclining to an edge forwards. The fins are seven in number, viz.: two dorsal, placed at some distance from each other; two pectoral, taking rise just behind the breathing-holes, which are five in number; two ventral, situated almost underneath the first dorsal; and lastly the caudal, occupying the tail both above and beneath, but longest on the upper part.

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* Nos foramina hæc meatus auditorios esse credimus. Willughb.

nor are we certain that any others have been observed by them; and if we may judge by their figures of each, it should seem that the first described was the most plentiful. That figured in Gesner is far from a bad representation, and the one engraved by Knorr in his Deliciæ is sufficiently accurate. This species differs from the first, in having the snout more narrow in proportion at the base, and the whole of it more slender in all its parts; whereas the first is very broad at the base, and tapers considerably from thence to the point. The spines on each side also are longer and more slender, and vary from 24 to 34 in the different specimens; we have indeed been informed of one which contained no less than 35 spines on each side of the snout; but we must confess that we have never been fortunate enough to have seen such a specimen. This is supposed to grow to as great a size as the former, and in the general make and shape of the body does not materially differ." (*Latham*, Trans. Linn. Soc., 1794, p. 278.)

The following description of *Pristis pectinatus* Latham (*Pristis granulosa* Bloch & Schneider) is taken from a specimen two feet long, from Key West, Fla.:

Snout to nasal-lobes, 3 in length of body to base of caudal; width of anterior end of saw between first two pairs of teeth, equal to the internasal space, ¾ the base behind last pair of teeth; saw with 26 teeth on a side; eye larger than spiracle, half interorbital space; width of mouth equal to its distance to front of nostril; teeth in mouth in about 70 series; width across outer angle of pectoral fins, 2¼ in length from eyes to base of caudal; width of body behind pectorals, 7. Height of pectoral slant in front, 3 in snout to mouth; dorsals subequal; caudal, with no lower lobe, equal to pectoral slant.

Color, uniform brown above, below light.

Family RHINOBATIDÆ.

12. **Rhinobatus glaucostigma** Jordan & Gilbert. GUITARRO.

Very common on sandy bottoms in the estuary or Astillero at Mazatlan, where the species was originally found by Dr. Gilbert.

Family NARCOBATIDÆ.

13. **Narcine entemedor** Jordan & Starks, n. sp. ENTEMEDOR.

Two specimens taken in the estuary at Mazatlan, and a third procured by Mr. James A. Richardson in the harbor of La Paz. Specimens had also been obtained by Dr. Gilbert, at Panama, in 1883, but having been destroyed by fire, the species has remained undescribed until the present time.

Snout 3¾ in length of disk; preocular part of snout equals preoral; interocular space in snout, 1½; width of mouth, 2¼. Eye much smaller than spiracle; spiracles edged with small tubercles. Length of disk equal to its width; disk equal to length of tail, without caudal fin; tail with a loose fold of skin on each side. First and second dorsals equal, rounded behind; ventrals large, ending midway between posterior edge of disk and caudal fin. Color: Pale olive brown, a little clouded with darker; second dorsal edged with pale; dots on head dusky.

Length of largest specimen, 20 inches. Type, No. 1699, L. S. Jr. Univ. Mus.

The Spanish name *Entemedor* seems to be equivalent to *Intimidator*.

Family DASYATIDÆ.

margin of pectorals and on middle of back, leaving smooth areas near middle of pectorals and over branchial arches; 16 to 20 large spinules along median line of back and tail.

Color, plain brown; caudal fin darker, edged with white.

This species differs from *Urolophus asterias*, in having a wider disk, more acute snout, much smaller prickles, and fewer spinules on back and tail.

Three specimens obtained in the Astillero, the longest 18 inches in entire length. Type, No. 1700, L. S. Jr. U. Museum.

This species is named for Dr. George Warren Rogers, a scholarly physician, native of Vermont, but long resident in Mazatlan.

16. **Urolophus umbrifer** Jordan & Starks n. sp.

Occasionally taken with *Urolophus asterias*, but much less common.

Disk round, not wider than long, its length greater than tail; snout pointed, not exserted. Snout from eye, 4½ in disk; eyes equal to spiracles; mouth 2 in distance to tip of snout; caudal spine inserted in front of middle of tail; skin perfectly smooth.

Color, brown above, with blackish cross-shades or bars, radiating from the shoulder; a dark band behind eyes, and one from eyes; caudal fin dark.

One adult female specimen, the uterus containing four young.

This is probably not identical with Garman's *Urolophus nebulosus*, being perfectly smooth and different in color.

17. **Dasyatis longus** Garman.

Rather common at Mazatlan, where specimens were also taken by Dr. Gilbert; also recorded by Mr. Garman from Acapulco and from Panama, and by Evermann & Jenkins from Guaymas.

18. **Pteroplatea crebripunctata** Peters. MANTARAIA.

Very common on sandy shores everywhere about Mazatlan, from which locality it was originally described; also taken by Dr. Gilbert.

Width of disk twice length to posterior end of anal slit; snout forming a regular curve from a little in front of middle of pectorals, a very small blunt projection at tip; anterior margin of disk convex near snout and lateral angles, pectorals concave medially; posterior margin weakly convex; posterior angle broadly rounded; lateral angle sharply rounded; distance from snout to a line drawn through lateral angles, 2½ times in distance to tip of tail.

Interorbital a little wider than its distance to tip of snout; eyes twice spiracles; mouth equals snout, 6½ in disk. Tail rat-like, with a scarcely perceptible fold of skin on its dorsal side.

Ground color olive brown, everywhere with small dark points, not so close set as in *Pteroplatea rava*, indistinct greyish spots, half as large as iris, scattered over

A line drawn through lateral angles would bisect a line from snout to tip of tail. Interorbital 1⅓ in snout; eye 1½ in spiracles; mouth 7 in disk, 1½ in snout; tail straight and slender, with a very slight fold on dorsal side.

Ground color light olive brown, thickly set with sharp cut black points; conspicuous grey or white spots, half as large as iris, scattered over the body, around which the black spots form rings; brighter yellowish spots and half spots around anterior edge of disk; tail mottled above with darker; lower parts chiefly light orange red or rust colored in life.

All the markings are very distinct and clear cut, the reddish of the belly conspicuous.

One specimen, 12 inches long. Type No. 1587, L. S. Jr. Univ. Mus.

20. **Ætobatus narinari** (Euphrasen). GAVILAN.

Rather common in the harbor of Mazatlan, where it was also taken by Gilbert; a beautifully colored species reaching a large size.

Length of disk 1⅔ in width; proximal half of anterior margin of pectoral fins straight, distal half convex; posterior margin concave, the end of each ray forming a small scallop; lateral angle sharp.

Snout forming an angle, from its tip to division of nasal-lobes, 1⅓ times breadth of head; width of snout 1⅛ times distance from its tip to the division of nasal-lobes; nasal-lobes projecting back over the mouth; width of mouth 1½ its distance to tip of snout; numerous blunt buccal papillæ around upper dental plate and on ridge between nostrils; interorbital 4¾ in disk; eyes smaller than spiracles, which are as long as base of dorsal. Ventrals well rounded, 3⅔ in length of disk; tail 3½ times disk. First caudal spine equals base of dorsal, which is half second spine.

Color bluish black with many round yellowish spots scattered equally over the back and ventral fins; spots about as large as eye on back, smaller on head, sometimes two spots run together forming an elliptical spot, about sixteen spots from eye along anterior margin of pectoral to lateral angle; posterior margin of pectoral very narrowly margined with white; ventral side pearly white.

From the description of *Ætobatus laticeps* this species differs in the following respects: disk not so broad; tail not so long; width of head and snout less; ventrals not truncated behind; pectorals not margined with blackish; spots on ventrals not assuming the form of ocelli.

Five large specimens obtained; length of disk in each, 15 inches.

This description has been compared by Dr. Barton W. Evermann, with specimens of *Ætobatus narinari* from Brazil. No difference of any importance appears, and in his judgment the Atlantic and Pacific Coast American forms are identical.

NOTE.—This species has been several times obtained by Dr. Gilbert and others in the Gulf of California, hav- [redacted] its width at a line in front of the nostril is as great as the distance from its point to interlobular nasal emargination. The rostro-frontal fontanelle is constricted at its anterior third; the interval between the crests of the anterior portion enters about 2⅔ times in the interorbital area; at the constriction, about 4 times; at the posterior portion, about 2⅔ times; the posterior portion gradually expands backwards and terminates with an oval contour behind. The nasal lobes are about twice as long as wide, their length externally exceeding half the length or breadth of the rostral area.

"The dental plate has a triangular contour; its anterior angle obtusely rounded.

"The dorsal commences immediately behind the pectoral fins. The ventral fins almost truncated behind, between the well rounded angles; their breadth 2½ times their length. The tail is four or five times as long as the body.

"The color is bluish-black above, relieved on the head by numerous, but rather distinct, whitish or yellowish spots, smaller than eye, much larger on the body and behind towards the sides, and on the ventrols sometimes assuming the form of ocelli; below white; pectorals margined with blackish.

"This species is closely related to *A. narinari* and its allies, and especially *A. latirostris* A. Dum., but is apparently distinguished by the combination of characters given in the diagnosis. It belongs to the genus *Goniobatis* Ag., proposed for a species with a more angular lower dental plate than in *A. narinari*, and is related to the *Goniobatis meleagris* Ag.* of the Sandwich Islands, but is distinguished by the more declivous forehead and the shape of the rostro-frontal fontanelle.

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* "This species has not been characterized, but a dried Aëtobatine obtained at the Sandwich Islands by the Wilkes Exploring Expedition probably belongs to it."

"A single specimen was forwarded to the Smithsonian Institution by S. E. Hubbard, Esq., of San Francisco, Cal." (Gill.)

21. **Manta birostris** (Walbaum).

Said to be frequently seen in the open sea about Mazatlan; not obtained by us.

Family SILURIDÆ.

22. **Felichthys pinnimaculatus** (Steindachner).

Occasionally taken in the estuary. Recorded by Gilbert from Mazatlan and Panama, by Steindachner from Altata, Costa Rica and Panama. Two specimens obtained by us.

23. **Felichthys panamensis** (Gill).

Not rare in the estuary, reaching a considerable size. Obtained by Gilbert at Mazatlan, Libertad, Punta Arenas; by Gill and Günther at Panama; and by Steindachner at Magdalena Bay, Altata and Panama. One specimen obof this condition, and that the species referred to it should be arranged in other groups.

As the dentition of the typical species of *Galeichthys* agrees in essential respects with that of *Hexanematichthys*, we unite the two groups under the earlier name, *Galeichthys*.

25. **Galeichthys gilberti** Jordan & Williams, n. sp. BAGRE BLANCO. Plate xxvi.

Extremely abundant in the upper part of the Astillero, along sandy bottoms, exceeding by far in numbers all other cat fishes. Also found by Gilbert at Mazatlan, whence it was erroneously recorded by Jordan & Gilbert as *Arius assimilis* Günther. Large numbers of this species are left on the beach after seining, and the various sea birds, pelicans, man-of-war birds, gulls and the like, come down to take possession of them. In two cases specimens of this cat-fish were swallowed by pelicans; the spines were erected after the fish was partly engorged, and these spines entering the skin of the sack of the pelican, made it impossible for the bird to swallow them or to dislodge them. Considerable numbers of pelicans are doubtless destroyed every year by attempting to swallow living cat-fish which have been left by the fishermen.

The following description is essentially that of Jordan & Gilbert, Bull. U. S. Nat. Mus., 1882, under the name of *Arius assimilis*. The type of that description, 29,213 U. S. N. M., from Mazatlan, coll., Gilbert, may be taken as the special type of the species, numerous co-types (numbered 1666, 1667 and 1668, L. S. Jr. Mus.), having been sent by us to different museums:

Head, $3\frac{4}{7}$ to 4; width of head, $5\frac{1}{3}$: depth, 5; D. I. 7; A. 4, 14.

Body comparatively elongate, the head depressed but not very broad, somewhat broader than high; eye rather large, 5 to 6 in length of head; width of interorbital space, 2¼ in head; breadth of mouth, 2⅗; length of snout, 3.

Teeth all villiform; bands of vomerine teeth separated by a rather wide interval, each small, roundish, confluent with the neighboring palatine band, the junction marked by a slight constriction; palatine bands ovate, broad behind, varying considerably in size and somewhat in form, the width ranging from one-third diameter of eye to two-thirds, being generally largest in adults; band of palatine teeth without backward prolongation; band of maxillary teeth rather broad and short, its length about five times its breadth. Maxillary barbel broad and flattened at base, reaching a little past base of pectoral in the young, scarcely to the gill opening in the adult; outer mental barbels, 2 in head, inner 3. Gill-rakers, 4+12.

Dorsal shield very short, narrowly crescent-shaped, its length on the median line not more than half that of one of its sides. Occipital process subtriangular, not quite much produced backward, less than half length of pectoral spine, its surface not granular, covered by skin. Adipose fin half length of anal, its posterior margin little free. Upper lobe of caudal longest and somewhat falcate, about as long as head. Ventrals unusually long about reaching anal in females, shorter in the males. Vent much nearer base of ventrals than anal.

Color olive green, with bluish luster, white below; upper fins dusky olivaceous; caudal yellowish dusky at tip; anal yellowish with a median dusky shade; ventral yellowish, the basal half of the upper side abruptly black; pectorals similarly colored, the black area rather smaller; maxillary barbel blackish; other barbels pale.

Length, 12 to 18 inches.

The following specimens from Dr. Gilbert's Mazatlan collections are registered in the United States National Museum:

28,161, 28,189, 28,210, 28,213 (2), 28,221, 28,232, 28,276, 28,304.

This species is nearest allied to *Galeichthys seemanni* (Günther), a Panama species. *Galeichthys jordani* (Eigenmann) from Panama differs in the gill rakers and in other regards. *Galeichthys assimilis* is an Atlantic species, not yet known from the Pacific Coast. With each of these *Galeichthys gilberti* has been at one time or another confounded. *Galeichthys gilberti* differs from *Galeichthys seemanni*, as described by Dr. Eigenmann, in the absence of pectoral pore, in the shorter spines and in the fontanelle not quite reaching occipital process; ventrals unusually long, no dark specks on side of belly, barbel short, compressed. As noted below, *Galeichthys gilberti* bears a superficial resemblance to *Netuma platypogon*. Its teeth are different, the ventrals are much longer, and the adipose dorsal much larger. *Netuma* *platypogon* has the sides of belly much soiled by dark specks.

26. **Galeichthys azureus** Jordan & Williams, n. sp. BAGRE AZUL. Plate xxvii.

Head 3¼; width of head 4$\frac{5}{9}$, depth 9. Length from tip of snout to tip of upper lobe of caudal fin 19¼ inches. D. I, 7: P. I, 10. A. 4, 14. Gill rakers 6+13.

Body robust, its width anteriorly greater than its depth; caudal peduncle short, stout; distance from end of anal fin to base of median caudal rays about one-half length of head. Head flat, very broad; its depth at posterior angle of jaw about one-half its width; interorbital region flat, smooth anteriorly and granulated posteriorly; fontanelle almost obsolete, wide anteriorly and ending in a short groove posteriorly at a point one-half distance from tip of snout to posterior end of occipital process; top of head, occipital process and dorsal shield finely granular, granulations mostly arranged in radiating striæ and extending forward to a line with the pupils, nostrils very large and close together; posterior one with a broad valve.

Occipital process pentagonal, its length 4½ in head, line of the vomer; form of vomerine bands similar to that of the palatine bands but smaller. Palatine band of teeth without backward prolongations.

Opercle with radiating ridges; humeral process granular, triangular, lower posterior corner prominent; axillary pore very small. Gill membranes forming a broad fold across isthmus.

Dorsal fin short, base not including spine equal to base of adipose dorsal; dorsal spine robust, but little shorter than pectoral spine, about two in head; its anterior serræ small and tubercle-like; its posterior edge, as well as that of pectoral, retrosely serrate; soft rays of dorsal extending but little beyond spine, the longest about three-fifths length of head. Adipose dorsal about one-half as high as long. Caudal lobes unequal, the upper lobe about one-third longer than lower lobe. Anal short, of medium height. Distance from vent to base of ventrals one-half distance from origin of anal. Pectoral spine very strong, its anterior margin with serræ towards the tip, which become small tubercles towards base; soft rays but little longer than spine, which reaches slightly beyond one-half distance from its origin to base of ventrals.

Color dark blue with silvery reflections on sides; belly pale, mental barbels dusky; maxillary barbels light below and black above; paired fins darkest on inner side; other fins almost uniformly dusky.

One specimen, 19¼ inches long, was taken by the Hopkins expedition in the estuary at Mazatlan. It is numbered 1575 in the collection of the Leland Stanford Jr. University.

27. Galeichthys guatemalensis (Günther).

Taken by Dr. Gilbert at Mazatlan; not seen by us. Also recorded from Chiapam (Günther), and the coast of Colima (Xantus).

28. **Netuma platypogon** (Günther).

Very common at Mazatlan; several specimens taken in Astillero, where it is scarcely less abundant than *Galeichthys gilberti.* Also recorded by Dr. Gilbert from Mazatlan, Libertad and Punta Arenas; by Günther from San José; and by Steindachner from Magdalena Bay and Callao. To the southward it is very abundant.

In some specimens, perhaps females, granulations are visible on the occipital process only, the other bones being covered by smooth skin, as in the subgenus called *Galeichthys.* This species much resembles *Galeichthys gilberti.* It is, however, readily known by the short, pale ventrals, as well as by the generic character of the backward extension of the palatine bands of teeth.

29. **Netuma kessleri** (Steindachner).

Recorded by Steindachner from Altata; recorded from Panama both by Gilbert and Steindachner. Not taken by us.

30. **Sciadeichthys troscheli** (Gill). BAGRE COLORADO.

Rather common in the Astillero at Mazatlan, reaching dorsal buckler shown in Steindachner's figure of *brandtii*. In that case *troscheli* and *brandtii* must be the same.

Family MURÆNIDÆ.

31. **Muræna lentiginosa** Jenyns. ANGUILA PINTA.

Not rare in the rocky places about the islands at Mazatlan, where a few specimens were taken by us. Numerous others, the types of *Muræna pinta*, were found by Dr. Gilbert. The species is widely distributed, having been recorded from Cape San Lucas (Xantus), Colima (Xantus), Panama (Rowell) and San Josef Island (Nichols).

32. **Lycodontis dovii** (Günther). ANGUILA PINTITA.

Not seen by us at Mazatlan. The original types of *Muræna pintita* (which we now identify with *dovii*) were taken at Mazatlan by Dr. Gilbert. Specimens which we have elsewhere referred to this species have been recorded from Espiritu Santo (Belding), Galapagos Islands (Herendeen) and from Panama (Günther).

The name *Gymnothorax* as originally proposed by Bloch, is an exact synonym of *Muræna* as understood by us. Of the many later names applied to this type, *Lycodontis* of McClelland seems to claim priority.

33. **Lycodontis castaneus** (Jordan & Gilbert).

This enormous eel is very common about the islands near Mazatlan, where numerous specimens were obtained both by Dr. Gilbert and by us. Our largest specimen is 5½ feet in length. The species is very close to the West Indian *Lycodontis funebris* (Ranzani), but is apparently distinct from the latter. The colors are not the same, *funebris* being of a greenish black and *casteneus* bordering upon purplish chestnut. This species and its congener *(funebris)* reach a larger size than any other American morays.

Family OPHICHTHYIDÆ.

34. **Myrichthys tigrinus** Girard. CULEVRA.

Not uncommon in the harbor of Mazatlan, where several specimens (types of *Ophichthys xysturus* Jordan & Gilbert) were taken by Dr. Gilbert. Several specimens were also obtained by us. It has been recorded also from Acapulco and Panama. The original types of *Myrichthys tyrinus* were said to come from Adair Bay in Oregon. It has, however, not yet been taken north of the Gulf of California, and the locality assigned to the type is very doubtful. We have not been able to find a bay of this name on any map of Oregon.

35. **Ophichthus triserialis** (Kaup.) (*Ophisurus californiensis* Garrett; *Herpetoichthys callisoma* Abbott.)

Recorded by Gilbert from Mazatlan; not seen by us. A specimen certainly belonging to this species has been lately obtained by Dr. Gilbert in the Bay of Monterey. The only other definitely known localities are Cape San Lucas and the Galapagos Islands, whence it was described as *Ophichthus rugifer* Jordan & Bollman.

Family MURÆNESOCIDÆ.

37. **Muræenesox coniceps** Jordan & Gilbert. Culevra Blanca, Anguila Blanca.

Very common about the islands in the neighborhood of Mazatlan. It reaches an enormous size, a specimen obtained by us being 6 feet and 10 inches long and having a girth of 22 inches.

Family CHANIDÆ.

38. **Chanos chanos** (Forskål). Sábalo.

Very common on the sandy shores of the bay, reaching length of about 5 feet. The flesh is poor, and the fish is seldom brought into the market, but is frequently used as bait. The hard enamelled scales are used for ornamental work by the Indians. We are unable to see any difference between our specimens and others brought by Dr. Jenkins from the Hawaiian Islands. We have no doubt that our species is identical with the common East Indian form.

Head 4⅖; depth 4; D. 2, 12; A. 2, 9; V. 12; scales 12–70–14; snout 3½ in head; eye 3½; maxillary 4⅓; pectoral 1⅗; ventral 1⅘; caudal ⅓ longer than head; dorsal 1¼ in head.

Body elliptical, moderately compressed, the caudal peduncle slender. Head pointed, rounded above. Eye and side of head covered by a large transparent, imperforate adipose eyelid. Mouth small, terminal, toothless, transverse, the lower jaw included: maxillary broad, slipping under the adipose preorbital, without supplemental bone. Branchiostegals 4. Opercle truncate behind. Pseudbranchiæ very large. Gill-rakers fine and flexible, very close set, rather long, the gill-rakers of all the arches bound together so as to form a perfect strainer. Bones of gill-rakers flexible. Scales firm, enamelled at base, with strongly marked longitudinal striæ, becoming bony when dry; used by the Indians for ornamental work. Lateral line well developed. Dorsal somewhat nearer snout than base of caudal, before ventrals, its first ray falcate, its last produced in a short filament, longer than pupil. Base of fin with a large scaly sheath; pectoral and ventral with scaly axillary appendage. Anal similar to dorsal, but much smaller. Pectorals and ventrals rather small; caudal very long, forked to the base, its lobes subequal, straight; base of fin with small scales. Ventrals somewhat falcate.

Brilliant silvery in color, greenish above; fins more or less darker; inside of pectoral and ventral blackish.

Stomach forming a muscular crop. Pyloric cæca many. Intestinal canal long, filled only with remains of plants.

The skeletal peculiarities of *Chanos* are numerous and remarkable, many archaic characters persisting. The following account of the skeleton has been prepared by Mr. Starks:

SKELETON OF CHANOS CHANOS.

On the upper part of the operculum is a large scale-like bone.

The suborbitals are well developed and plate-like, extending back nearly to the posterior edge of the preopercle.

b. Vertebral Column.

There are forty-two vertebræ in the spinal column.

The first vertebra is co-ossified to the skull, and apparently bears no ribs; the second vertebra supports a pair of very small, slender ribs, which articulate directly with the sides of the vertebra; the third vertebra supports the first pair of large ribs; they are articulated with the transverse processes.

The first fourteen or fifteen neural spines and pairs of transverse processes are articulated with the vertebræ by sutures, they are easily separated from the vertebræ by boiling or maceration.

The vertebræ gradually increase in size and reach their largest size about two-thirds of the distance from the anterior to the posterior end of the spinal column, where they are three or four times the size of the anterior ones. This character is more marked in the adult than in the young.

c. Shoulder Girdle.

The shoulder girdle is exceedingly well braced, the post-temporal is widely forked, and strongly articulated to the epiotic processes of the skull.

The supra-clavicle is long and slender, its posterior face is hollowed out and attached some distance from the upper end of the clavicle, which projects upward.

This projecting upper end of the clavicle is braced to the skull by two long bones.* The first bone is very slender, at its anterior end it is connected to the exoccipital; near its middle it is connected with the posterior end of the post-temporal, at which point it turns at a sharp angle and runs to the clavicle. The second bone is much larger, it is articulated to the basioccipital. Its posterior edge is nearly straight for its whole length, but its anterior edge is produced and much swollen near its middle, and joins the post-temporal over the first bone, then runs to the upper end of the clavicle.

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* See Dr. R. W. Shufeldt's report on the osteology of *Amia calva;* Bull. U. S. F. C., 1883, page 59.

The inner part of the clavicle and the coracoid are thin and pierced by many holes, so that the bone in places is little more than network.

The hypercoracoid has a very large foramen; at its posterior edge is a projection which supports a thin bone, probably a dermal bone.

The mesocoracoid is well developed.

There are four actinosts; the first is long, but they rapidly decrease in size to the fourth, which is short and triangular.

The first ray of the pectoral is large at the basal end, and hollowed out; it works directly on the hypercoracoid.

d. Branchial Apparatus.

The septæ between the myotomes are ossified about half an inch under the skin, forming long, slender rays of bone.

There is an upper series running from the middle of the sides up on the back, and a lower series from the sides down on the belly, they form a sort of a basket around the body. Those below have a single branch near the middle of each, the ones above have two branches each, these branches are lost towards the posterior end.

These bones are not present in the young.

The large caudal fin is attached very firmly to the hypural, the long rays of each lobe join the hypural at about the same oblique angle, the base of each ray is deeply divided and articulated immovably with the hypural. The middle short rays are all nearly horizontal and are much less firmly fastened.

The first interspinal ray of the anal is hollow and cone-shaped, the posterior end of the air-bladder runs into it as in the genera *Eucinostomus* and *Calamus*. The scales are very thick and closely imbricated; the skin anteriorly is a quarter of an inch thick.

Family ELOPIDÆ.

39. **Elops saurus** Linnæus. CHIRO.

Very common in the estuary, ascending into brackish mud puddles at high tide; not valued as food. Also found by Gilbert at Mazatlan.

Family ALBULIDÆ.

40. **Albula vulpes** (Linnæus). SANDUCHA.

Very common in the estuary at Mazatlan; not valued as a food fish. Also found by Gilbert at Panama and Mazatlan. The band-shaped young, which Dr. Gilbert has shown to be the larvæ of this species, were obtained in abundance.

Family CLUPEIDÆ.

41. **Sardinella stolifera** (Jordan & Gilbert). SARDINA DE ACEITE. Plate xxviii.

Exceedingly abundant in the Astillero at Mazatlan, where many specimens were taken by Dr. Gilbert, as well as by the Hopkins expedition. This species is also recorded by Gilbert from Panama, and has been found in several other localities. The flesh of this sardine is very rich and delicate, quite equal to that of the European Pilchard *(Clupanodon pilchardus)*, and it is therefore a most excellent pan fish. It is, however, not eaten by the Mexicans, no fish having less than one-half pound weight being salable in the market at Mazatlan. The art of properly cooking delicate fish like this is unknown to the people of this region.

42. **Opisthonema libertate** (Günther). SARDINA MACHETE.

Common in shallow water, in the surf and in the harbor at Mazatlan, where it was also taken by Dr. Gilbert.

43. **Opisthopterus lutipinnis** (Jordan & Gilbert).

between preopercle and base of caudal. Teeth strong, sharp, unequal in both jaws; small teeth in patches on palate and tongue. Maxillary pointed behind, reaching middle of eye.

Color bright silvery, bluish above; a very distinct black spot at shoulder on level of eye, two-thirds diameter of eye; chin and nose black. Fins all pale, with no yellow; a trace of a broad diffuse, lateral streak of silvery, most distinct in young. Upper ray of pectoral dusky, some pale olive spots on back, very faint.

Very many specimens taken, the longest 5½ inches in length.

Family ENGRAULIDIDÆ.

44. **Stolephorus miarchus** Jordan & Gilbert.

Obtained by Dr. Gilbert in the open water about Mazatlan; not found by us. These translucent type speciments are apparently immature, but the small number of anal rays would indicate that it is a species distinct from any other now known.

The immature or larval specimens obtained by us in the open sea have the fin-rays of *Stolephorus ischanus* and must belong to that species.

45. **Stolephorus exiguus** Jordan & Gilbert.

Originally found by Dr. Gilbert in the Astillero at Mazatlan; not seen by us.

46. **Stolephorus curtus** Jordan & Gilbert.

Rather common in the Astillero at Mazatlan, where it was originally found by Dr. Gilbert. Numerous specimens taken by us.

47. **Stolephorus ischanus** Jordan & Gilbert.

Very common in the Astillero at Mazatlan, where it was originally found by Dr. Gilbert. Many specimens obtained.

In the open sea many slender larvæ, similar in form to *Stolephorus miarchus* were obtained by the use of dynamite. The number of anal rays shows that these larvæ belong to the present species.

48. **Stolephorus lucidus** Jordan & Gilbert.

Originally found by Dr. Gilbert in the Astillero at Mazatlan; not obtained by us.

49. **Stolephorus scofieldi** Jordan & Culver, n. sp.

* Head 3¾ to $3\frac{9}{10}$ in length to base of caudal; depth 4½ to 5; eye 3¾ to 4 in head; dorsal 12; anal 25 or 26; scales 41 or 42.

Close to *Stolephorus delicatissimus*, but with larger head, wider lateral band, and greater number of dorsal and anal rays.

Body somewhat compressed and elevated, the belly not carinated or serrated. Teeth in both jaws, and on palatines; a few on vomer. Maxillary covered with teeth its entire length and reaching beyond base of mandible, but not to opercular margin.

Gill-rakers 10+12, the longest a little more than half the eye.

the head; shortest caudal ray 2½ in longest. Pectorals not reaching ventrals, 1¾ in head. Both anal and dorsal fins preceded by a rudimentary spine, not half length of first true ray.

Color translucent, with a distinct broad silvery stripe as wide as the eye, growing more diffuse at lower anterior edge, narrowing on caudal peduncle, and becoming fan-shaped on the base of caudal. Tip of snout black; a distinct median band of black specks extending from tip of snout to base of caudal. No distinct black markings on fins.

Length, 3 inches. Type, No. 2941, L. S. Jr. Univ. Mus.

Found in the Astillero at Mazatlan, not very abundant.

Named for Mr. Norman Bishop Scofield, a member of the Hopkins expedition to Sinaloa.

50. **Anchovia**[*] **macrolepidota** (Kner & Steindachner).

Originally described from the neighborhood of Panama; recorded by Dr. Gilbert from the Bay of Mazatlan, but not seen by us there; apparently rare.

Family SYNODONTIDÆ.

51. **Synodus scituliceps** Jordan & Gilbert. CAIMAN.

Not very common, on sandy bottoms in the Bay, where the species was originally found by Dr. Gilbert; also recorded from Panama.

Color brown, with markings of pale bluish green. No yellow anywhere.

52. **Synodus jenkinsi** Jordan & Bollman.

Not rare, occurring in deeper water than the preceding and reaching a much larger size. The two species are very closely related, but seem to be distinct. In *Synodus*

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[*] *Anchovia* (Jordan & Evermann, Fishes of North America), is a new generic name applied to this species, distinguished from *Stolephorus* by its robust form and the absence of teeth in the adult.

jenkinsi, the head is much larger and the form more robust, besides slight differences in the scales. The specimens obtained were sent to us by Señor Ygnacio Moreno after our departure from Mazatlan.

Family PŒCILIIDÆ.

53. **Pœcilia butleri** Jordan.

Common in the fresh waters of the Rio Presidio below the village of Presidio, where the species was originally taken by Mr. Alphonse Forrer.

Head 3½; depth 2¾ to 3⅓; dorsal 9; anal 6; scales 26–9; eye 3 in head, equal to snout; interorbital 2; pectoral 1¼ in head; caudal equal to head. Longest dorsal ray 1¼ in head in male; 1⅔ in female.

Body much deeper and more compressed than in *Pœcilia presidionis*, the profile rather steeply rising to front of dorsal. Dorsal and ventral outlines of head meeting at mouth and forming a somewhat sharp point; snout as viewed from above, truncate. Teeth in two series, the inner smaller, more close set, not trifid, the two series well separated. Interorbital space wide and flat, about with a dark spot behind pectoral; lower fins bright orange, caudal nearly plain; dorsal speckled as in male. Form similar to that of male, deeper than in *Pœcilia presidionis*.

Alcoholic specimens show no dark spot behind pectoral and only a few specimens show traces of orange coloration on fins.

The following is a list of the species of fishes found in the fresh waters of Rio Presidio about Presidio and Villa Union:

Sardinella stolifera. Scarce.
Pœcilia butleri. Rather common.
Pœcilia presidionis. Very common.
Thyrina crystallina. Rather common.
Agonostomus nasutus. Very common in ripples.
Siphostoma starksii. Common in algæ in sluggish water.
Centropomus ensiferus. Common in cut-offs of rivers.
Centropomus pedimacula. Scarce.
Eucinostomus gracilis. Common.
Xystæma cinereum. Not rare.
Heros beani. Common in deep places.
Philypnus lateralis. Common (young very common).
Eleotris æquidens. Scarce.
Dormitator latifrons. Common.
Awaous taiasica. Common.
Citharichthys gilberti. Not rare in river; colors very bright.
Achirus mazatlanus. Very common.
Achirus fonsecensis. Scarce.

54. Pœcilia presidionis Jordan & Culver, n. sp. Plate xxix.

In the clear waters of the Rio Presidio, about Presidio; with the preceding, and still more abundant.

Head $4\frac{1}{3}$; depth $3\frac{1}{5}$ to $4\frac{1}{5}$; D. 7 or 8; anal 7; scales 28–9; eye equal to snout, $3\frac{1}{2}$ in head; interorbital 2; caudal 1 to $1\frac{1}{5}$; pectoral $1\frac{1}{4}$. Body rather elongate, shaped as in a *Fundulus*, the profile scarcely rising to dorsal.

Teeth much as in *Pœcilia butleri*, the outer smaller than in *butleri;* broad and movable, apparently in two well separated series, the inner row similar to the outer, but smaller.

Fins all low and short, except anal in male, in which the first one or two rays are produced and extend back nearly to the caudal fin.

Dorsal in female inserted over middle of anal, behind anal in male; caudal truncate.

Female greenish above, sides with violet sheen; three or four black cross bars, sometimes obsolete in adult, but very distinct in young; one or two blackish oblong spots before the anterior bar, representing other bars; a dark pencil-like streak on sides of body below the scales; a dark blotch on opercle; a trace of a dark ocellus on last ray of dorsal at base. Fins without spots; lower fins plain; a dark streak along edge of caudal peduncle; faint traces of black markings on edge of dorsal and caudal.

Male much smaller, reddish, with the lower fins yellowish; the coloration generally similar; both sexes rather dull.

Type, No. 2687, L. S. Jr. Univ. Mus.

56. Tylosurus stolzmanni (Steindachner). SIERRITA.

Occasionally taken in the harbor of Mazatlan, where specimens, the types of *Tylosurus sierrita*, were taken by Dr. Gilbert. One large specimen obtained by us. Its measurements differ somewhat from those given in the type of *Tylosurus sierrita*. The distance between the eyes is 8¾ in head. The maxillary reaches beyond the vertical from front of pupil. The eye is 3 in postorbital part of head. Head not quite 2 in length. D. 1.15; A. 1.17. Pectorals with dusky specks, but not notably black at tip.

This fish is probably identical with *Tylosurus stolzmanni*, described by Steindachner from Tumbez, Peru. The snout in our specimen, as in the type of *sierrita*, is shorter than in *Tylosurus stolzmanni*.

Family HEMIRAMPHIDÆ.

57. Hyporhamphus roberti (Cuvier & Valenciennes). PAJARITO.

Exceedingly common about Mazatlan, swimming in schools in open water, especially numerous in the bay; those of the same age and size go together. Schools of adults and schools of half grown specimens will be found, each moving about independently of the other. It is highly valued as a food fish, although distinctly inferior to *Sardinella stolifera*.

Lower jaw, measured from tip of upper, two times length of rest of head. Snout, 2½ in head.

This species is found along the whole Pacific Coast of tropical America, and from Cape Cod to the mouth of the Rio Grande, being everywhere common southward. We have seen no specimens from the West Indies.

The type of *Hemirhamphus roberti* Cuvier & Valenciennes, came from Cayenne, coll. Poiteau. Through the kindness of our friend, Dr. F. Bocourt, of the Museum at Paris, we have received a drawing of this specimen. In the drawing the lower jaw, from tip of upper, is 1¾ times length of head. The head, with lower jaw, is 1⅚ times in length from tip of upper jaw to base of caudal. The ventral is midway between front of eye and base of caudal. The name *roberti* belongs, therefore, to the common long-jawed form; the short-jawed West Indian form being *Hyporhamphus unifasciatus*.

Family SYNGNATHIDÆ.

58. **Siphostoma starksii** Jordan & Culver, n. sp. CULEVRA DE RIO. Plate XXX.

Common in the Rio Presidio in sluggish water, on the bottom, about a mile below the village of Presidio. The species is probably found in brackish and fresh waters rather than in the sea.

Head 10½; depth 21; dorsal 38, on 0+10 or 11 rings. Rings 13 or 14+37 or 38. Head and body in tail 2. Snout 2⅗ in head. Dorsal half longer than head.

Body rather stout. Head scarcely carinate above. Snout with a slight smooth carina. Two lateral keels, confluent into one behind.

sembles the preceding, but its dorsal fin has but 20 rays, being placed on $0+5$ rings.

60. Hippocampus ingens Girard. CABALLITO DE MAR.

Rare in the harbor at Mazatlan. Three male specimens and one female, each about six inches long, obtained. Also recorded by Dr. Gilbert.

D. 19. Rings about $11+36$; dorsal on $3+2$ plates.

Spines on head and body high, with large fringed flaps and with many small papillæ. Every 3d to 5th tubercle of dorsal series enlarged.

Greatest depth $1\frac{1}{10}$ to $1\frac{1}{3}$ in head. Tail longer than rest of body. Snout moderate, $2\frac{1}{5}$ to $2\frac{1}{4}$ in head, rather longer than opercle, $2\frac{1}{3}$ times eye. Shoulder girdle with three tubercles; anterior spine on frontal triangle much smaller than the others.

Color blackish, unspotted, faintly barred with darker; dorsal speckled with black and edged with white; papillæ on body pale, giving an appearance of scattered whitish dots everywhere; a white speck before eye; a faint trace of radiating streaks behind it; one specimen further dotted with black on body, the radiating streaks behind eye distinct.

Here described from an adult male, 6 inches long. The female is entirely similar except that the body is much more slender, the depth $1\frac{3}{5}$ in head; the snout is longer, as long as rest of head.

The male specimens agree fairly with the description of *Hippocampus ingens*. The female evidently corresponds to *Hippocampus gracilis* Gill.

Family FISTULARIIDÆ.

61. Fistularia depressa Günther. CORNETA.

Common in the Bay at Mazatlan; many specimens taken with the seine in shallow water. Also, found in abundance by Dr. Gilbert; not yet recorded from localities further south.

Family ATHERINIDÆ.

62. **Eurystole eriarcha** (Jordan & Gilbert). Plate xxxii.

One specimen found in a rocky pool by Dr. Gilbert; a second one taken by us with a seine on the sandy beach just south of Mazatlan. Only these two specimens are known, and the species is probably rare. This species is allied to the genus *Menidia* rather than to *Atherina*. It differs from the species of *Menidia* chiefly in the extremely long anal fin and in the smallness of its dorsal, which is unusually far backward. These characters have been used by Jordan and Evermann to define the genu *Eurystole*, of which this species is type. The mouth is shorter than in *Menidia*, but its structure is exactly the same.

Head 5; depth 5; dorsal III–I, 11 or 12, anal I, 27; scales about 48.*

Body short, deep, much compressed; head short, deep, about ¼ longer than deep, rather broad above; opercles, truncate behind, the interorbital space about equal to eye. Mouth very small, terminal, very oblique, with curved not falcate, inserted high, 1⅓ in head, 6 in body, reaching to the middle of the small ventral. Belly not especially compressed, not cultrate. First dorsal very small, slightly nearer snout than base of caudal, over first ray of anal; last ray of dorsal much before last of anal. Anal very long, somewhat elevated in front, its base 3 times in length of body. Soft dorsal and anal scaleless.

Color translucent green, very pale; back, lips and bases of vertical fins faintly dotted; lateral band very broad and highly silvery, about two-thirds as broad as eye; lower fins pale; air-bladder not visible through the flesh.

One specimen, 2¾ inches long.

63. **Thyrina evermanni** Jordan & Culver, n. g. and n. sp. Plate xxxiii.

Common in the estuary. In this species the structure of the mouth is exactly as in *Thyrina crystallina*. It differs from that seen in *Menidia* only in having the upper jaw shorter. It is apparently closely related to the genus *Atherinella* of Steindachner, but it has not the toothed scales of the type of that genus, *Atherinella panamensis*. The other characters of *Atherinella*—the great length of the pectoral fin, the great compression of the breast and the long anal fin—are shared by this species which we have made the type of a new genus, *Thyrina*. The name (θύρις, window) refers to the translucent sides. Both *Eurystole* and *Thyrina* are intermediate between *Menidia* and *Atherinella*.

Thyrina evermanni differs from *Thyrina crystallina* in the longer anal, the more falcate pectoral, the smaller scales, more compressed breast and the absence of black on the fins.

Head 4¾; depth 4⅔ to 5; dorsal IV, I, 7; anal I, 23 to I, 25; scales 36–9; eye 2⅔ in head; snout 3⅖ in head; maxillary 3⅔ in head; lower jaw 2⅔ in head;

pectoral 1¼ longer than head, 3½ in body; caudal slightly longer than head; interorbital space broad, nearly equal to eye.

Body much compressed, the belly sharp edged, concave on each side below pectorals, as if pinched together between the fingers, the ribs reaching the edge, the scales passing around it; the edge almost carinate. Back narrow. Scales smooth, none on dorsal or anal. Mouth small, terminal, the short jaws curved, the structure precisely as in *Menidia*, the teeth moderate, curved, those in the upper jaw longer; opercles oblique behind, not vertically truncate. Gill-rakers numerous, long and slender. Pectorals very long and falcate, reaching to front of anal and beyond tips of the short ventrals, their posterior margin conçave; spinous dorsal small, inserted midway between edge of preopercle and base of caudal, about over sixth ray of anal; last ray of dorsal considerably before last of anal; base of anal 1⅔ times length of head, 2¼ in body.

Color, light green, much dotted above, translucent below; a black streak of dots along base of anal; some on sides of head; median line of back dusky; fins all pale; no black on spinous dorsal, ventral or pectoral; lateral

Head 4¾; depth 4½ to 5; dorsal IV–I, 8; anal I, 21; scales 40–11; pectoral ⅕ longer than head, 4¼ in body; anal base more than half longer than head, 3 in body; eye 2¾ in head; snout 3¼; maxillary 2⅔; lower jaw 2½.

Body rather deep and compressed; snout shortish; opercle shortish, rounded behind; mouth small, the upper jaw very protractile, the premaxillary strongly curved; jaws equal; teeth rather strong, the outer curved, those in upper jaw largest; eyes very large, silvery; breast compressed, as in *Thyrina evermanni*, but less sharp at edge, appearing as if pinched between thumb and finger; pectoral long, pointed, not truly falcate, reaching more or less past the middle of the short ventrals, its posterior margin not concave, the middle rays considerably more than half length of upper rays; dorsal and anal naked; gill-rakers numerous, long and slender; first dorsal small, behind front of the long anal, midway between gill opening and base of caudal; first ray of soft dorsal over about fourth of anal; last rays of soft dorsal considerably before last of anal. Caudal lunate, the lower lobe the longer and broader, as long as head. Color, translucent green, with considerable dusky dottings, no yellow; fins dotted; ventrals black, as are lobes of second dorsal and anal; silvery stripe narrow, little more than half diameter of the eye; first dorsal and base of anal dusky; air-bladder evident through the translucent sides of body, but less clearly so than in *Thyrina evermanni*.

In fresh water, very common in the lower Presidio; many specimens taken; the longest 3¼ inches long. Type, No. 2685, L. S. Jr. Univ. Mus.

Family MUGILIDÆ.

65. **Mugil cephalus** Linnæus. Lisa Macho. Lisa Cabezuda.

Very common in the bay of Mazatlan; a fish of almost universal distribution on both coasts of tropical America, and extending to Europe. We are unable to distinguish the specimens from the two coasts one from another, and find no permanent difference between these and specimens from the Mediterranean. This species is largely used as food, and often enters lagoons and sheltered places.

66. **Mugil curema** Cuvier & Valenciennes. Lisa Blanca.

Excessively common everywhere, especially in the harbor and estuary. This species is also valued as a food, but reaches a considerably smaller size than the other. In life the iris is tinged with orange, and there is an orange spot on the side of the head behind the eye. This species, like the preceding, is very widely distributed, being found on both coasts of tropical America.

67. **Mugil hospes** Jordan & Culver, n. sp. Lisita. Plate xxxi.

length of its pectoral fins as compared with *Mugil curema*. The Crustacean is also common and characteristic of the same species at Panama.

Head 3⅔ to 4; depth 4 to 4⅓; D. IV–8; A. III, 9; scales 38–13; eye 4½ in head; snout 4; maxillary 4.

Body a little slenderer and more compressed than in *Mugil curema*, the back considerably more arched, the profile evenly curved from tip of snout to soft dorsal. Eye moderate, with a large adipose eyelid. Head broad and round above; interorbital width 2⅖ in head. Teeth very small, perceptible with a lens. Tip of lower jaw forming about a right angle. Space between dentaries club-shaped, very much larger than in *Mugil curema*, the subopercles barely touching below. First dorsal inserted above middle of body nearly over tip of ventral spine. Second dorsal moderate; its edge incised. Upper lobe of caudal a little longer than lower, as long as head. Anal rather high. Ventral inserted before middle of pectorals. Pectoral very much longer and more pointed than in *curema*, 1¼ in head.

Soft dorsal and anal covered with small scales.

Color much as in *curema*, rather greener above, sides silvery, with less trace of longitudinal streaks. Fins pale; base of pectoral with a round black spot. Upper edge of pectoral and end of caudal dusky. No golden on head. Iris with a little brown, green above eye.

Types, Nos. 1695, 2890, 2954, L. S. Jr. Univ. Mus.

68. **Mugil setosus** Gilbert.

Four young specimens taken in a rock pool. The pectoral is as long as in *Mugil hospes*, reaching the first dorsal, and there is a distinct dark blue spot at its base. Color bluish above, much as in *Mugil curema*; much darker than in the original types of the species, with which our specimens have been compared. The original specimens came from a bottom of volcanic ashes.

69. **Chænomugil proboscideus** (Günther). LISITA.

Very common in rocky places, reaching a length of about 6 inches; not found by us in open water.

70. **Querimana harengus** (Günther). VERDE.

Very common in the bay and estuary; often seen swimming in schools on the surface after the fashion of whirligig beetles; occasionally taken in rock pools. Back bright green, in life with a large, shining, silvery spot on each side of the back. This spot becomes inconspicuous when the fish is taken out of the water, but is a prominent recognition mark while the fish is swimming.

71. **Agonostomus nasutus** Günther. TRUCHA.

Extremely abundant in the fresh waters of the Rio Presidio, especially in the swift places or ripples. It reaches a length of over a foot, but most of the specimens are much smaller.

Head 4 to 4¼; depth 4⅓ to 4½; dorsal IV–I, 8; anal usually II, 10, very rarely II, 9; scales 43–13; maxillary 3⅓ to 3⅙; eye 3⅔ to 4⅓; snout 3⅔ to 4; pectoral dimentary; second 3⅓ in longest soft ray. First soft ray slender, but articulate, half length of longest ray.*

Olivaceous, sides creamy, white. Many scales on sides punctate so that black scales seem scattered among the others. A conspicuous black bar at base of pectoral, followed by a white streak; a narrow black rim around lower half of eye. Fins all creamy yellow, the upper ones blotched and dotted with blackish. Young with a black blotch surrounded by orange on first dorsal. Spot on pectoral distinct at all ages.

Family SPHYRÆNIDÆ.

72. **Sphyræna ensis** Jordan & Gilbert. VICUDA.

Rather common in the harbor, where it was found by Dr. Gilbert; also recorded from Panama by Gilbert, and from San Bartholomé Bay and Panama by Steindachner. An excellent food fish, but reaching a smaller size than most species of the group.

Family POLYNEMIDÆ.

73. **Polydactylus approximans** (Lay & Bennett). RATON.

Very common, especially on sandy beaches; many specimens taken by us; also recorded by Gilbert from Mazatlan and from other localities. Used as food.

74. **Polydactylus opercularis** (Gill.)

Obtained by Dr. Gilbert from Mazatlan and Panama; not seen by us.

Family HOLOCENTRIDÆ.

75. **Holocentrus suborbitalis** Gill. MOJARRA CARDENAL.

Very abundant in all rocky pools about Mazatlan. It reaches only a small size, barely exceeding six inches, and its coloration is less red than that of the Atlantic species of the genus.

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* Apparently taken for a spine by Dr. Günther, who counts A, III, 9.

Head 3; depth $2\frac{2}{3}$; D. XI, 12; A. IV, 8; scales 3–36–7; longest dorsal spine $1\frac{3}{4}$ in head; longest dorsal ray $1\frac{3}{4}$; caudal lobes $1\frac{1}{3}$; third anal spine $1\frac{2}{3}$; pectoral $1\frac{3}{5}$; ventral rays I, 7. Seven scales on cheek. Maxillary slipping under preorbital. Ventral with accessory scale. Dorsal lying in a groove.

Body short and deep, compressed, with slender caudal peduncle; anterior profile rounded. Mouth small; upper jaw protractile. Teeth in villiform bands on jaws, vomer and palatines. Maxillary moderate, slipping under the very narrow preorbital, which, like rest of suborbital ring, is armed with close-set sharp teeth, turned backwards. Preopercle, opercle, subopercle, interopercle and postemporal armed with similar teeth. Preopercular spine nearly as long as pupil; nearly as long as eye on large specimens. Two spines on opercle.

Steel gray, underlaid by bright coppery red, which becomes brighter after death. Everywhere much punctate with black, the dots coarse. Sides, and especially back, with purple reflections. Top and side of head coppery; a curved bright silvery streak from tip of snout, below dark. Ventral reddish, the spine and first soft ray whitish, the first ray dark red; when the fin is closed it seems reddish, edged with whitish or yellowish, and with a blackish line. The dark is fainter in larger specimens.

It is not impossible that *Rhamphoberyx pœcilopus* Gill is the very young of this species. *Rhamphoberyx leucopus* may be the young of *Myripristis occidentalis*, which has the ventrals plain.

Family MULLIDÆ.

76. **Upènus grandisquamis** Gill. Chivo. (*Upenus tetraspilus* Günther.)

This small species, rarely exceeding a foot in length, is generally common in the harbor and estuary at Mazatlan, where it was found also by Dr. Gilbert. It seems to be everywhere common on the coast.

Color evanescent, olive with two rows of light bluish green spots toward back, then a bronze band, then a blue streak on level of pupil; 2 or 3 yellowish streaks below it. Sides of head golden, with a light green streak forward from eye and some blue behind eye. A large black blotch below last dorsal spine. First dorsal reddish, clouded with dark. Second mesially black, edged with orange. Caudal and anal red. Ventral and pectoral pale.

In alcohol much red appears. In life, sides with curved light yellowish brown, cross bands most distinct on the silvery lower parts.

Family SCOMBRIDÆ.

77. **Germo alalunga** (Gmelin).

Recorded from near Mazatlan by Lay and Bennett; not seen by us, it being probably a migratory fish coming in the spring or fall.

78. **Scomberomorus sierra** Jordan & Starks, n. sp. SIERRA.

Rather common in the harbor at Mazatlan, numerous specimens being taken; also found by Dr. Gilbert at Panama. This is not valued as a food fish, little attention being paid to it by fishermen. This, however, may be due to the lack of appreciation of good fishes by the people of Mazatlan, who have not learned the art of properly cooking any fish.

This species is very closely allied to its Atlantic cognate, *Scomberomorus maculatus*. It differs in the slightly more backward insertion of its soft dorsal, in its coloration, the spots in *maculatus* being elliptical and fewer in number, and perhaps in the fewer pores in the lateral line (175 in *maculatus*). In *Scomberomorus maculatus* the soft dorsal is inserted one eye's diameter before anal.

Head 4¾; depth equal head; dorsal XVIII–15–IX; anal II–15–IX; maxillary 1¾ in head; eye 5 in head; pectoral 1¾; ventral 3½; dorsal and anal lobes equal, 1¾ in head.

Body elongate, its dorsal and ventral outlines about of spots below the lateral line, these spots decrease in size towards the belly, covering both sides nearly to level of pectoral.

Types, 1720, L. S. Jr. Univ. Mus.; the largest 24 inches long.

Family CARANGIDÆ.

79. **Oligoplites altus** (Günther). MONDA.

One large specimen taken by us. Recorded by Dr. Gilbert from Mazatlan and Panama.

80. **Oligoplites saurus** (Bloch & Schneider). MONDA.

Common in the harbor of Mazatlan, where it was also taken by Gilbert. On comparison of specimens from Mazatlan with others from Havana we are unable to find any difference whatever. The species called *inornatus* is therefore fully identical with *saurus*.

81. **Trachurops crumenophthalmus** (Bloch).

Common in the harbor at Mazatlan, where numerous specimens were taken: not recorded by Dr. Gilbert. Specimens have been compared with others from Havana and no difference of any kind is observable. *Trachurops brachychirus* must therefore be regarded as an exact synonym of *Trachurops crumenophthalmus*.

82. **Caranx vinctus** Jordan & Gilbert.

Rather common in the estuary, where numerous specimens were taken. The original types were found by Gilbert at Mazatlan, and the species has been recorded from San Blas and Punta Arenas.

83. **Caranx caballus** Günther. COJINERO.

Extremely common in the harbor; also found in abundance by Dr. Gilbert.

84. **Caranx medusicola** Jordan & Starks, n. sp. Plate xxxiv.

Rather common in the surf outside the harbor. Not found in the Astillero. The young from 1 to 2 inches long live in the body cavity of the large white jelly fish, which is very abundant about the Venados Islands in January. Sometimes two or three specimens will be found in the body cavity of one jelly fish.

Head $3\frac{2}{5}$; depth $2\frac{1}{5}$; D. VII–1, 22 or 23; A. II, 1, 19 or 18; scutes 30 to 32; pectoral $\frac{1}{6}$ longer than head; dorsal lobe $1\frac{2}{3}$ in head; caudal lobe, as long as head; curve of lateral line $1\frac{1}{2}$ in straight part; height in chord 4; eye 4 in head; snout 3; maxillary 3; ventral $2\frac{1}{3}$.

Body unusually deep and compressed, the back elevated, the belly similarly arched; head moderate, deep, the nape arched. Mouth small, maxillary broad, with broad supplemental bone. Teeth in moderate bands, the outer enlarged but not canine-like; upper teeth rather larger and in broader bands. Villiform bands on vomer, palatines and tongue. Eye moderate; preorbital rather narrow. Gill-rakers rather long and slender, about 12

Another example was, in life, blue above, silvery below; no dark spots on opercle or pectoral; pectoral bright yellow, very long. D. and A. and C. lobes, all tipped with black. Base of dorsal bright blue. Anal and dorsal largely blue. Base of caudal peduncle green above. No trace of bands; a slight dusky shade on axil.

The very young, taken from the body of a *Medusa*, may be thus described:

Head 3 in length; depth 2⅚; dorsal IX, 24; anal II, I, 18 or 19; ventral with a sheath; scales minute; caudal keel scarcely appreciable; lower jaw projecting; mouth oblique; body deep, compressed; caudal peduncle slender, the fin short, moderately forked; pectoral short, not falcate, shorter than head; maxillary broad, reaching pupil; preorbital narrow; dorsal and anal not falcate; lateral line arched before, then straight; jaws with teeth; preopercle with flexible spines.

Clear white, fins all pale, a bright violet blue area above and behind eye, fading in spirits; dark dots above; dorsals both dusky at tip.

85. **Caranx marginatus** (Gill).

Not rare in the Astillero, where several specimens were taken by us. This species is well distinguished from *Caranx latus*, with which it has hitherto been confounded, since it was originally described by Dr. Gill. The following are its characters:

Head 3⅓; depth 2⅔; dorsal VIII–1, 19; anal II–1, 15; eye 3⅔ in head; pectoral 3⅓ in length, equal to head; ventral 7¼; dorsal lobe 5¼: caudal 3⅔.

Dorsal outline of body evenly curved from snout to caudal peduncle; ventral outline straight from gill openings to anal spine, behind which it is curved like the dorsal portion.

Top of head, snout, lower jaw, orbitals, maxillary, lower two-thirds of opercle and preopercle naked; cheeks scaled; eye large, with membranous eyelid to posterior edge of pupil in specimens six or eight inches long, not conspicuous in young examples. Snout equal to eye, twice width of preorbital; lower jaw entering profile; maxillary reaching to posterior edge of orbit. Teeth strong, in a single row; lower teeth close together, with two canines in front; upper teeth larger, the distance between them irregular, not much enlarged anteriorly; vomer, palatines and tongue with exceedingly small villiform teeth. Gill-rakers hardly half eye, 4+13. Breast scaled; curved part of lateral line, 1½ in straight part; scutes large, about 30; scales, 80.

Color, silvery, bluish above with golden reflections below; a dark band along plates of lateral line; fins largely yellow, dorsal, anal and caudal, broadly edged with black; a distinct small black spot at upper end of gill-opening; a dark blotch on opercle, and one behind pectoral.

Body more elongate than in *Caranx latus*, the fin rays fewer, the eye larger and the coloration more yellow, to see any difference between specimens from the west coast and specimens from Havana.

88. Gnathanodon speciosus (Forskål). MOJARRA DORADA.

Very common in the harbor and estuary, being one of the more valuable food fishes, the flesh being firm and delicate. We have compared specimens with others taken by Dr. Jenkins at Honolulu and find no difference. We have, therefore, no hesitation in continuing to identify our species (*Caranx panamensis* Gill) with this common East Indian fish, of which the oldest name is *speciosus*.

In life, everywhere deep golden yellow, with black cross bands.

89. Citula dorsalis (Gill). PÁMPANO.

Rather common in the estuary. Three specimens taken by us, one half-grown and the others adult, the change in form being strikingly marked, as will appear from the following descriptions:

Citula dorsalis (half grown):

Head 3⅕; depth 1¾; D. VI–I, 19; A. II, 1, 17; eye 4¾ in head, the orbit 3½ : snout 2⅔; pectorals 2½ in body, ⅕ longer than head; ventrals 3; caudal lobe equal to head; dorsal with one long filament, as long as body, reaching middle of caudal; anal with one filament; caudal moderately elongate, the lobes equal; pectoral very long, falcate, reaching tenth anal ray; ventrals small, reaching just past vent.

Body deep, compressed, rather ovate than angular; profile straight from the vertical truncate snout to nape, then rounded, then straight to front of dorsal. A nearly straight line from chin to front of anal. Eye rather small, preorbital deep. Mouth large, the lower jaw included. Teeth small, in broad bands on jaws, vomer and palatines, maxillary reaching pupil. Cheek entirely scaly, some scales on opercle above. Breast naked, body well scaled. Body with small scales, the nuchal region naked, scarcely carinate. Gill-rakers rather long, 2+15.

Lateral line evenly curved, the curve high, equal to straight part. Scutes small, eighteen with keels; the total number of scales on straight part 58.

Steel blue above, silvery below, with golden reflections and shades; fins all pale, tinged with yellowish, none of them dusky; no black on pectorals. Axil jet black; opercle slightly dusky, blackish within; a dark spot on orbit above.

Specimen described, ten inches long.

Citula dorsalis (adult):

Length 24 inches; head 3¼; depth 2¼; D. 18; A. 17. About 25 scutes developed. Body moderately compressed, with angular outlines. Profile of head rounded, of belly somewhat concave, forming an angle at anal similar to one at front of dorsal. Eye 5 in head. Maxillary 2½; lower jaw included. Teeth in broad villiform bands on both jaws and on vomer and palatines. Nostrils large,

90. **Alectis ciliaris** (Bloch). PÁMPANO.

Obtained by Dr. Gilbert; not seen by us. We have hitherto been unable to distinguish the specimens of this species from the two coasts of Mexico. We are furthermore unable to find any distinction between the American form called *crinitus*, and the East Indian species, *Alectis ciliaris*. We do not believe that any distinction exists, and therefore find ourselves compelled to believe that this species, like *Caranx hippos* and *Caranx latus*, is almost cosmopolitan in the tropical seas, ranging from the coast of Arabia to the West Indies. None of the three are found in the Mediterranean.

91. **Hynnis hopkinsi** Jordan & Starks, n. sp. PÁMPANO. Plate XXXV.

One large specimen taken with the seine in the harbor at Mazatlan.

Head 3½; depth 2⅕; D. VI-1, 18; A. II, 1, 15; snout 2¾; eye 3⅚ in head; maxillary 2¾; pectoral, 3⅕ in body; ventral, 2¼ in head: dorsal lobes 2⅕ in head: caudal lobes 1⅖ in head; anal lobe, 2¼; preorbital, 4¼ in head.

Body oblong, compressed, elevated, with angular outlines, ventrals outline sharp. Top of head sharply carinate; profile nearly straight from snout to nape, there boldly convex, then nearly straight to elevated front of soft dorsal; a concavity in profile before soft dorsal and before anal. Mouth oblique, rather large, the jaws equal. Broad bands of small sharp teeth on jaws, vomer and palatines. Eye very large. Dorsal and anal lobes low. Lateral line with a long arch, as long as straight part, which has about twelve elevated scutes and thirty-seven scales in all from end of curve; curved part of lateral line undulating behind. Gill-rakers short rather few, twelve in all, those above angle obsolete. Body minutely scaly. Belly and lower parts largely naked, a large patch of scales on cheeks; head otherwise naked.

Bright blue above, with bright reflections, sides bright silvery; no golden; a narrow brownish streak not quite so wide as pupil from upper part of gill opening to middle of base of soft dorsal. Pectoral tipped with black; axil of pectoral dusky. Upper fins rather dusky, lower white. Dusky on opercle inside and out but without definite spot.

More elongate than *Citula dorsalis*, the anterior profile more convex, the base of dorsal and anal more elevated, the caudal scutes stronger and fewer, the ventrals longer though the specimen is larger. Gill-rakers fewer. Pectoral long and falcate, reaching seventh anal ray. Ventrals not short, reaching vent. Caudal moderate.

One specimen obtained, twenty-six inches long, No. 1563, L. S. Jr. Univ. Mus.

We take great pleasure in naming this interesting fish for Mr. Timothy Hopkins, in recognition of his great interest in scientific research.

We provisionally admit *Citula* and *Hynnis* as genera

Head 3; depth 2; dorsal V–1, 15; anal (II) I–14; eye 4 in head; snout 1¾; maxillary 2¾; ventral 3⅓; caudal lobes equal to head; pectoral one-eighth longer than head.

Body compressed and elevated; profile oblique, concave over snout then straight to occiput, which is well rounded; line of back straight to soft dorsal, then lightly curved to caudal peduncle; ventral outline rounded on breast to ventrals, then straight to anal, forming an angle at first ray, then straight to caudal peduncle. Mouth projecting, with minute teeth on jaws, vomer, palatines, and tongue; gill-rakers thick and blunt, many of them knobbed at tip—in old examples at least, one above angle with 3 or 4 rudimentary ones, and 13 below. A large bony knob at occiput, conspicuous in adult, the thickened supraoccipital crest.

Pectoral falcate, reaching to tenth anal ray; dorsal and anal lobes filamentous, reaching past tips of caudal lobes; lateral line strongly arched; curve equal to straight part. Color silvery, with bluish reflections above, dorsal and caudal dark, pectoral, ventral and anal white; axil dusky.

94. **Selene vomer** (Linnæus).

One large specimen obtained by us. Recorded by Dr. Gilbert as common at Mazatlan and Panama. It perhaps disappears with the end of the autumn, going farther south.

95. **Trachinotus paloma** Jordan & Starks, n. sp. PALOMA.

A few small specimens taken in the surf at Puerto Viejo, just north of Mazatlan; other specimens were taken by Mr. Xantus on Cape San Lucas, and still others were obtained by Dr. Gilbert in San Juan Lagoon. The species is apparently not common, and it is not known to the fishermen. On the Atlantic coast, the very closely related Pámpano, *Trachinotus carolinus*, is one of the most valued food fishes. We are unable to see any difference of any importance between the present species and the Pámpano of the gulf other than the fact that in the Sinaloan form the head seems to be larger and longer. On this difference we have ventured to give a new specific name to our specimens from Mazatlan. We shall not, however, be surprised if the species proves inseparable from *Trachinotus carolinus*.

Allied to *Trachinotus carolinus*, but with the head larger.

Head 3, depth 2½; D. VI–I. 24. A. II, I, 23; eye 3½ in head; snout 3⅔; maxillary 2⅓; dorsal lobe 1⅔; caudal 1⅒.

Body rather elongate, the back moderately and regularly arched; snout bluntish. Mouth large, horizontal, the lower jaw included, maxillary reaching past pupil. Lateral line little arched, its curve 1⅙ in straight part. Teeth well developed. Caudal not widely forked.

Silvery without spot or band; anal creamy orange, its tip whitish. Other fins pale, except dorsal lobe which is they are marked by shades of brownish red or maroon color. There seems to be little doubt that the *Trachynotus rhodopus* Gill is the young of the species which he called at the same time *Trachynotus fasciatus*. The very young specimens to which Gill gave the name *Trachynotus nasutus* were probably also the young of the same species, but it may be that they were the young of *Trachinotus kennedyi*. Dr. Jordan's identification of the great Pàmpano of the Florida Keys with Gill's *Trachynotus rhodopus* is doubtless incorrect. There is at present no evidence that any species of *Trachinotus* is common to both coasts of Mexico.

Young specimens, 2½ inches long. Blue above, white below, no bars. Dorsal and caudal lobes black, with strong orange shade. Lobes of caudal orange brown, verging on black. Pectoral and ventral white.

Specimens 6 or 7 inches long, have from 3 to 5 narrow dark cross-bars, not quite so wide as pupil, running from a point on a level with pectoral fin to within a short distance of the dorsal line of the back, but never quite to it; these bars vary in number and position; posterior face of pectoral fin dusky. Otherwise colored as the younger ones.

97. **Trachinotus culveri** Jordan & Starks n. sp. PALOMETA. Plate xxxvi.

Five specimens, each 7 inches long, obtained in the market at Mazatlan; no others seen. This species is related to *Trachinotus falcatus* of the Atlantic, but its fins are lower and different in coloration. It is also allied to *Trachinotus kennedyi*, but the body is much deeper and there is no black axillary spot. It does not seem possible that with age *culveri* should become transformed into *kennedyi*.

Head $3\frac{2}{3}$: depth 1½: D. VI–1, 17: A. II–1, 17; maxillary 3 in head; eye 3⅔; snout 4⅓; dorsal lobe 1$\frac{1}{10}$ in head; pectoral 1⅓ in head; caudal $\frac{1}{6}$ longer than head.

Body very deep, compressed, the back much elevated. Snout very blunt and convex, the rest of profile straight and steep; base of dorsal and anal very oblique. Dorsal and anal lobes rather low. Caudal long. Lateral line little elevated in front, the curve 1¼ in straight part. Gill-rakers very short, about 5+9. Teeth persistent, in specimens 7 inches long.

Bluish gray, silvery below, tinged with yellow, everywhere much soiled with blackish spots, no distinct markings anywhere, the axil only slightly dusky; fins all dusky except middle of caudal and lobe of anal, and the ventrals which are whitish.

Types, No. 2691, L. S. Jr. Univ. Mus.

98. **Trachinotus kennedyi** Steindachner. PALOMETA.

Two large specimens obtained in the surf. This species was originally described by Steindachner from Magdalena Bay, and has been recorded by Dr. Gilbert from Mazatlan and from Panama.

Head 3⅔; depth at vent 2⅓; at anal 2$\frac{1}{10}$; D. VI–1, Gray above, with deep green reflections, lower half silvery, with strong golden tinge. Axil jet black, the color covering base of fin and extending behind for a distance nearly equal to eye, so that the fin does not cover it; upper fins dusky, the caudal edged with paler, anal dusky with golden tinge, ventrals purplish white. Pec torals dusky; 'maxillary with a black streak.

99. **Seriola mazatlana** Steindachner.

Originally described from Mazatlan by Steindachner, but not seen by Dr. Gilbert or by us; probably a migratory species.

Family NEMATISTIIDÆ.

100. **Nematistius pectoralis** Gill. PAPAGALLO.

Very common in all the waters about Mazatlan; specimens reaching the length of about three or four feet found about the islands of Venados, Isla Blanca and Creston.

Color silvery, iridescent bluish above, with black bands; the first across tip of snout; the second across interorbital, involving the top of membranous eyelid; the third from nape across opercle; the fourth including the first dorsal spine and running obliquely down on the belly, where it fades out at about the tip of the pectoral fin; the fifth running from middle of first dorsal obliquely to lateral line, then backwards along lateral line to upper lobe of caudal, including the whole upper half of caudal peduncle; a sixth indistinct band, following the line of the back for a short distance, under the soft dorsal; upper part of maxillary dusky; long spines of dorsal with alternate bands of yellow and black, and much slaty-bluish at base; soft dorsal and caudal uniform dusky; pectoral with a black spot on lower rays, not involving the axil; ventrals white; anal slightly dusky.

Described from a specimen sixteen inches long.

The two anal spines united with rest of the fin. No free anal spines. Ventral ray really I, 5, the inner ray very wide, made up of four branches so that the rays seem more numerous; ventral spine obscure. Anal fin short. Pectoral fin falcate. Both dorsal and ventral with sheath. Soft dorsal and anal low, the last ray slightly lengthened.

Dr. Gill is probably right in regarding *Nematistius* as type of a family distinct from the *Carangidæ*.

Family STROMATEIDÆ.

101. **Rhombus medius** (Peters).

Originally described by Dr. Peters from Mazatlan; not seen by Dr. Gilbert or by us. Only the original type in the museum at Berlin seems to be yet definitely known.

Family CHEILODIPTERIDÆ.

102. **Apogon dovii** Günther.

This species was found by Dr. Gilbert at Mazatlan, but was not seen by us.

103. **Apogon retrosella** Gill. CARDENAL. Plate xxxvii.

Two specimens of this most beautiful little fish were

Bright scarlet much dotted with black, cheek with many dark points, a diffuse dark blotch on opercle; a diffuse black blotch at base of caudal. First dorsal with triangular red area in front. Second dorsal red at base, the anterior half jet black above the red, the posterior half translucent. From black anterior rays, a rather faint black saddle falls to middle of side. Caudal red at base, upper and lower lobes black, the middle pale. Anal red at base, the anterior rays black, the posterior pale. Pectoral white, the base deep scarlet. Ventral white, red at base, blackish at tip. Opercle reddish within, with some dusky. Preopercle minutely serrulate on its vertical margin only, these serrulations soft and easily rubbed off.

A younger specimen was, in life, scarlet, deeper below and on tail, fading on fins; second dorsal, anal, and caudal tipped with blackish. An oblong inky spot at middle of base of caudal. An inky bar below soft dorsal extending to level of pectoral and spreading on base of soft dorsal. A black bar from snout through eye to gill opening, broader and clearer behind, overlaid by reddish, a fainter dusky band below parallel with it.

Family SERRANIDÆ.

104. **Alphestes multiguttatus** (Günther).

This species is found in rocky places along the coast, having been taken by Gilbert at Mazatlan and Panama. But one small specimen was obtained by us.

105. **Epinephelus labriformis** (Jenyns). CABRILLA PINTA.

This species is generally common about the islands on the coast of Mexico all the way from Cape San Lucas to the Galapagos Islands. Only young specimens were seen by us.

Inside of mouth salmon yellow; pectoral with salmon color, its edge pale; caudal with a maroon band above and below; dorsal edged with blackish red, spots on belly nearly white; dorsal with white on membranes.

106. **Epinephelus analogus** Gill.

This species is also common in rocky places along the coast from Mazatlan to Panama. Several specimens were obtained by us.

107. **Promicrops guttatus** (Linnæus). MERO.

Rather common about the islands and in deep water, reaching an enormous size, greater than that of any other bony fish found in the region. The largest seen by us weighed some seventy pounds, but it is said to attain the weight at times of 500 or 600 pounds. Only one specimen was obtained in a condition for preservation. This was a small one 20 inches long. The species was found by Dr. Gilbert at Mazatlan, Panama and Punta Arenas; the type of *quinquefasciatus* were obtained by Dr. Bocourt at Tauesco.

This species seems to agree fully with the account of

109. Mycteroperca boulengeri Jordan & Starks, n. sp.
CABRILLA RAIZER. "MANGROVE GROUPER."
Plate xxxviii.

This species is found with *Mycteroperca jordani* Jenkins & Evermann in about equal abundance. It reaches a much smaller size than any other species of *Mycteroperca*. It is in many ways an aberrant form, showing affinities with *Epinephelus*. The anal fin is short, as in *Epinephelus*, while the general appearance and coloration is that of *Mycteroperca*. The structure of the skull shows that its affinities are with the latter.

Head $2\frac{4}{5}$ in length; depth $2\frac{5}{6}$. Dorsal XI–14 or 15; anal III–9 or 10; scales about 90, 20 above and 42 below; snout 3½ in head; maxillary $2\frac{1}{5}$; eye 5½; pectoral 1¾; ventral $1\frac{5}{6}$; longest anal ray 1⅔; caudal $1\frac{3}{5}$; longest dorsal spine 2½; gill-rakers short, about 6+17, the longest about $\frac{3}{5}$ eye; longest dorsal ray 2 in head; length 10 inches.

Body short and deep, compressed. Head moderate, compressed, its profile not steep, nearly straight, a depression before eye. Upper canines moderate, the lower quite small. Nostrils small, well separated, the anterior slightly larger. Lower jaw very strongly projecting. Maxillary reaching opposite posterior edge of pupil. Preopercle slighily notched, the angle slightly salient, with enlarged teeth. Dorsal not deeply notched, the fourth spine not much elevated. Second dorsal high, not long, its angle not rounded. Caudal scarcely lunate, the upper lobe long, the lower truncate. Anal very high, strongly elevated; its posterior border incised, the anterior rounded. Pectoral and ventral moderate. Scales smoothish, not very small.

Color olive gray, covered everywhere with oblong irregular markings of black, between which the ground color forms rivulations. Gray lines radiating from the eye. A black blotch below maxillary. Pectoral olive yellow. Other fins blackish, clouded with pale. First dorsal with faint small black spots.

The supraoccipital and temporal crests are high, the supraoccipital crest extending to the posterior margin of orbit; the temporal crests are parallel to each other, and extending to pupil; interorbital space concave.

Several specimens, the largest (No. 1621, L. S. Jr. Univ. Mus.) one foot in length, taken in the Astillero at Mazatlan.

We take pleasure in naming this interesting species for Dr. George Albert Boulenger of the British Museum, in recognition of his excellent work on the *Serranidæ*, in the first volume of his Catalogue of the Fishes of the British Museum, the proof sheets of which have been kindly placed in our hands.

110. **Mycteroperca rosacea** (Streets). CABRILLA CALAMARIA.

Occasionally taken at Mazatlan in rather deep water. Three specimens only of this species have been preserved;

told by Dr. George W. Rogers and others that specimens weighing 150 pounds are not uncommon. The specimen from which the species is described was taken by the explosion of dynamite outside in the deep water not far from the island called Isla Blanca.

Head $3\frac{1}{8}$ in length; depth 3¼. Scales, small, smoothish, about 130. Dorsal XI, 16; anal III, 11. Snout 3 in head; maxillary 2; eye 8. Gill-rakers 3+8; pectorals $1\frac{9}{10}$; 4th dorsal spine $3\frac{3}{8}$; longest dorsal rays 3; longest anal ray $2\frac{1}{8}$; caudal lobe 1¾; ventrals 2¼.

Body robust, not strongly compressed, the head large. Lower jaw much projecting. Posterior nostril three times diameter of anterior. Preopercle scarcely notched, its angle scarcely salient, its teeth a little enlarged. Gill-rakers short, thick, few in number. Dorsal deep notched, 2d spine a little lower than the 4th. Soft dorsal high, slightly angulated. Anal very high, with exserted rays. Caudal well forked, lobes unequal.

Color olive brown, almost uniform; no spots or bands. Dorsal, anal and caudal with broad black margin narrowly edged with whitish. Pectoral and ventral darker behind. Pectoral with pale edge.

The type, a specimen weighing in life seventy-five lbs., has been sent as a skin to the British Museum. Its length was 40 inches to base of caudal fin.

112. **Mycteroperca pardalis** Gilbert. CABRILLA PINTITA.

This species is said to be rather common at the Venados and other islands in the neighborhood of Mazatlan. A single specimen was obtained by us; a head was also found in the market. Dr. Gilbert tells us that he has seen salted specimens apparently of this species preserved by the fishermen at Guaymas, together with specimens of a very large species, probably our *Mycteroperca venadorum*.

Head 3 in length; depth 3⅒; dorsal XI, 16; anal III, 11. Scales 100, small, smooth, imbedded, difficult to count. Eye 6⅔ in head; maxillary 2½; pectoral 1⅔; longest anal ray 1¾; longest dorsal 2; longest dorsal spine 3½. Caudal upper lobe 1⅓; ventrals 2.

Body deep, robust; anterior profile rather steep and straight; lower jaw moderately projecting. Small canines in both jaws; preopercle with notch and a salient angle. Gill-rakers about 15+25, rather stout, the longest about 7½ in head; snout 3½. Posterior nostril oblong, 4 times as long as anterior. Dorsal spines low, the third and fourth but little longer than the last. Dorsal fin pointed behind; anal very high, triangular in form; anterior margin convex, posterior concave. Sixth soft ray very high, reaching far beyond tip of last, which is short; spines graduated. Caudal fin broad, on a broad peduncle, unequally lunate; upper lobe longer and broader than lower. Pectorals rounded.

Color olive gray, paler below, clouded with dark above. Everywhere covered with small roundish dark olive or

113. Mycteroperca jordani (Jenkins & Evermann).
CABRILLA DE ASTILLERO.

Common in the Astillero at Mazatlan, reaching a much smaller size than any of the three preceding, the largest among them not being more than two pounds in weight. It is not found about the rocks, but lives in abundance in the branches of the Astillero on the muddy bottoms below a growth of the mangrove bushes.

Head 2¾, depth 3⅕. D. XI, 15. A. III, 10. Scales 23–125–43. Gill-rakers 3+10, short, barely longer than pupil. Eye 6½ in head; snout 3⅔; maxillary 2⅓. P. 1⅘. V. 2. 4th D. spine 3. Longest soft ray 2¾. A. 2⅕. C. 1¾.

Body moderately elongate, compressed; profile anteriorly a little convex, depressed before eye. Mouth moderate, the lower jaw longer. Nostrils well separated, subequal. Preopercle scarcely notched, the teeth at angle scarcely enlarged. First dorsal low, scarcely notched, the fourth spine not elongate. Soft dorsal low and rounded. Caudal truncate or very slightly rounded. Anal high but not rounded, its posterior border not incised. Pectorals and ventrals moderate.

Color olive gray, with very obscure marks of darker olive in the form of diffuse dark clouds; lower parts pale olive. Pectorals yellowish green; other fins blackish, the soft dorsal and caudal narrowly edged with whitish. Sides of head with wavy blackish streaks; a black mustache behind maxillary; lower side of head clouded, lower lip greenish.

Several specimens, each about a foot long.

An adult specimen of the same species shows the following characters:

Head 2⅔ in length; depth 3¾. Dorsal XI, 17; anal III, 11. Scales 120. Snout 3¼ in head; maxillary 2;

eye 7½; pectoral 1¾; ventral 2⅕; anal ray 2⅕; caudal 1⅘. Longest dorsal spine 2⅗; longest dorsal ray 2⅗. Gill-rakers short 3+8, not longer than pupil.

Body robust, rather elongate. Head large, low, its profile not steep, a depression before eye. Canines in both jaws, rather strong. Nostrils well separated, the posterior scarcely longer than anterior. Lower jaw strongly projecting. Preopercle slightly notched, the angle little salient. Dorsal rather deeply notched, the fourth spine not especially elevated. Second dorsal high and long, with rounded angles. Caudal slightly lunate. Anal high, but not falcate, its middle rays much elevated but not exserted; both outlines nearly straight.

Color olive almost black above, with four series of oblong blackish, cloud-like blotches along sides; these irregular in size, the largest twice length of eye. Fins all dark, clouded with darker. A little dark red on pectoral and on the lower edge of anal and caudal. Pale edge on dorsal, anal, and caudal very slight; none on pectoral. Cheeks and opercles clouded, the cheeks faintly reticulate, the lower parts grayish, faintly mottled. Inside of mouth pale.

narrow, ¾ width of eye. Interorbital area convex, its width 4½ in head. Nostrils small, the posterior scarcely the larger, separated from the anterior by one diameter. Angle of preopercle scarcely salient, but provided with coarser teeth; a small sharp notch above it. Opercular spine flat and divided into about six teeth at the end. Gill-rakers moderate 9+18. Scales moderate, scarcely ctenoid. Dorsal spines low, the outline of the spinous dorsal gently convex, the fourth spine longest, 3 in head. Soft dorsal high, its outline angular, the tenth ray produced, 1⅝ in head. Anal fin formed as in *Mycteroperca falcata*, its seventh ray produced and falcate, 1⅘ in head, its posterior outline concave. Caudal subtruncate, the outer rays slightly produced. Pectoral 1¾ in head.

Color plain dark olivaceous, the edges of the fins scarcely darker; no evident markings on body.

115. Paralabrax maculatofasciatus (Steindachner).
CABRILLA PINTA.

Rather common at Mazatlan. This is one of the very few northern species which extends its range thus far to the southward. It is found in some abundance about San Diego, and its center of distribution is probably between Mazatlan and San Diego, these two places being the limits of its range, so far as now known.

116. Diplectrum radiale (Quoy & Gaimard).

This small species is about a foot in length and is generally common on the Coast. It is apparently not very abundant at Mazatlan, the few specimens seen by us being all taken in the Astillero.

Much cherry red on head and fins in life, sides salmon color, streaks on head greenish.

117. **Prionodes fasciatus** Jenyns.

Generally common in rocky islands on the Coast. Obtained by Gilbert from the islands about Mazatlan, whence it was described as *Serranus calopteryx.* Not taken by us.

Serranus bulleri, lately described by Dr. Boulenger from Las Peñas, Jalisco, seems to be identical with *Prionodes fasciatus.*

118. **Rypticus xanti** Gill. JABON.

This species was found by Gilbert in some abundance at Mazatlan. It was not seen by us.

Family CENTROPOMIDÆ.

119. **Centropomus viridis** Lockington. ROBALO.

A common and valued food fish at Mazatlan, where it was also taken by Dr. Gilbert.

This Pacific Coast fish seems to be really a species distinct from *Centropomus undecimalis*, with which it has hitherto been identified. The only differences we find are these: In *Centropomus viridis* the anterior appendages to the air-bladder are two to three times diameter of

121. **Centropomus pedimacula** Poey. Robalito, or Constantino de las Aletas Prietas. (*Centropomus medius* Günther.)

Rather common, reaching a length of a little more than a foot; found at Chiapam (Günther), San Blas (Nichols) and Punta Arenas (Gilbert).

We find but one difference between the Pacific form called *Centropomus medius* and its Atlantic analogue, *Centropomus pedimacula* Poey. In the Pacific specimens, *Centropomus medius*, the second anal spine is curved and 1½ to 1⅜ times in head. In *Centropomus pedimacula* it is straightish and longer, 1¼ to 1⅓ in head. This difference is of very doubtful value, and for the present we place *medius* in the synonymy of *pedimacula*.

Color greenish, the sides bright silvery. Ventral pale yellow, black at tip, a little yellow on anal, none elsewhere. Upper fins dusky; dusky on anal behind the spine.

122. **Centropomus robalito** Jordan & Gilbert. Constantino, or Robalito de las Aletas Amarillas.

Rather common in the estuary and freely ascending the fresh waters, numerous specimens being taken by us in various places in the Rio Presidio. The species was found by Gilbert at Mazatlan and at Panama; it is probably generally common along the coast.

At our request, Dr. Evermann has compared specimens of the Pacific form called *Centropomus robalito* with *Centropomus ensiferus* from Cuba. He is unable to find any differences, and probably the two are identical. *Centropomus armatus* Gill from Panama is, however, distinct from *ensiferus* or *robalito*.

Olivaceous with bluish reflections; sides silvery, brightest above; ventrals bright yellow, not black at tip. Anal more or less bright yellow; upper fins dusky.

Family LUTIANIDÆ.

123. **Hoplopagrus guntheri** Gill. PARGO COCONACO.

This beautiful and most interesting species is very common about Mazatlan in deep water among the islands. It reaches a considerable size, the largest specimen seen by us having a length of 26 inches. There is considerable difference between the young and the old in coloration, the bands so conspicuous disappearing with age. The species has been found in abundance at Cape San Lucas, Altata and Guaymas, but has not been noticed further south.

Adult greenish above, belly coppery pink; head olive, sides with eight cross bands of warm brown, unequally placed; fins dusky olive shaded with pinkish and brown; ventrals black tipped. A dark crescent at base of pectoral.

124. **Lutianus novemfasciatus** Gill. PARGO PRIETO. PARGO MAREÑO.

This species reaches a much larger size than any other members of the genus on the Pacific Coast, those specicaudal 1¾; preorbital 3⅚ (4⅓ in smaller specimens 20 inches long; 5 in those of one foot long).

Body very robust, not much compressed, the back not sharp. Head very large, the mouth very large, reaching middle of eye. Canines very strong, in front of jaw and on sides of lower. Vomerine teeth in a V-shaped patch, not prolonged behind. Gill-rakers 7, very small, the longest less than pupil. Posterior nostril oblong, much longer than anterior. Preopercle slightly notched; 7 or 8 rows of scales on cheeks.

Dorsal deeply notched, rather low. Soft dorsal low and rounded. Anal low and rounded. Pectoral long and pointed. Caudal short, scarcely concave. Anal spines short, graduated. Scales above lateral line not in a parallel series.

Maroon color above, copper red below, becoming salmon color before. Fins blackish, tinged with maroon. Pectoral dull yellow olive, blackish at tip; a blackish cross spot on base of pectoral, growing faint with age. Inside of the mouth salmon. Ventral quite dark, the tips black. Iris salmon color; no blue spots or line below eye.

Young with spinous dorsal edged with black; anal and caudal black; ventrals black tipped. A black crescent on upper part of base of pectoral.

Young of one foot, black with progressively less red and narrow preorbital. Color largely blackish, tinged with copper on belly and lower parts.

The young are called Pargo Negro; the half grown, Pargo Prieto; the adult Pargo Mareño, or Maroon Snapper.

125. **Lutianus argentiventris** (Peters). PARGO AMARILLO.

Very abundant everywhere about Mazatlan, and probably common all the way from Guaymas to Panama. It reaches a weight of about five pounds, and is a food fish of some importance.

Back olivaceous, anterior parts washed with maroon red, bright on sides of head, becoming more orange posteriorly; posterior half of body bright yellow; some pale streaks on scales. Pectoral light orange red. Other fins mostly bright yellow. A row of round blue spots below eye. Belly silvery, slightly washed with red; inside of mouth white; iris white.

126. **Lutianus colorado** Jordan & Gilbert. PARGO COLORADO.

This large, handsomely colored species, is one of the staple food fishes at Mazatlan, being brought into the market every day, both from the estuary and from the deep water about the islands. It reaches a weight of about ten pounds. Thus far it has been recorded only from Mazatlan and Punta Arenas, all the known specimens having been collected by Dr. Gilbert.

127. **Lutianus guttatus** (Steindachner). PARGO FLAMENCO.

128. Lutianus aratus (Günther). PARGO RAIZERO.

This beautiful species is not very abundant about Mazatlan, specimens being only occasionally taken. It rarely reaches five pounds in weight. It is generally distributed along the coast, having been recorded from Punta Arenas by Gilbert, and from Chiapam and Panama by Günther.

Dark green, the dark stripes on sides dark brown, the interspaces yellowish white; belly coppery red; some bluish on cheek; pectoral maroon red; ventrals salmon red, the first ray white: anal creamy red; caudal dark red, blackish towards tip; dorsals dusky; throat silvery.

129. Rabirubia inermis (Peters). Plate xxxix.

The original type of this species in the museum at Berlin was said to have been brought from Mazatlan. A single specimen from Panama is in the museum of Stanford University. In this species the supra-occipital crest is continued forward on the head to the ethmoid region, as in the genus *Ocyurus*. This character widely separates *inermis* from the genus *Lutianus*. The genus *Rabirubia* Jordan & Fesler, of which it is the type, is separated from *Ocyurus* chiefly by the small number of the gill-rakers.

Family HÆMULIDÆ.

130. Hæmulon sexfasciatum Gill. RONCADOR ALMEJERO.

This species reaches a larger size than any other of the group, none that were found by us being less than two feet in length. It is not very common, living mainly about the islands. It was obtained by Peters and Gilbert at Mazatlan, and ranges from Cape San Lucas to Panama.

131. **Hæmulon scudderi** Gill. RONCADOR PRIETO.

This species reaches a length of about fifteen inches, and is very common at Mazatlan, more so than any other member of the group. Large specimens were taken by dynamite in the deep water about the Venados, and the young are rather common in the estuary. The species seems to have indifferently eleven or twelve dorsal spines, and there is a greater variation than usual in the form of the body and in the shade of coloration. There seems to be no doubt, however, that all the forms usually referred to this species belong to a single one. The species is found from Cape San Lucas to Panama.

Back bright yellow-olive to opposite front of soft dorsal, the posterior half, more or less abruptly, steel blue black. The vertical fins all blackish; in some the whole back is greenish, in others only half; lower parts all gray; most of the large ones show no traces of spots on scales, some show a few spots; fins silvery, with golden above and below; mouth red within; black under preopercle.

132. **Hæmulon steindachneri** (Jordan & Gilbert). RONCADOR RAIADO.

Fins all golden yellow: body dark bronze, with rows of pearly blue spots: a large black blotch at base of caudal.

133. **Lythrulon flaviguttatum** (Gill). (*Hæmulon margaritiferum* Günther.)

This species is not very common in the estuary at Mazatlan, a few specimens having been taken by Dr. Gilbert. It is widely distributed along the coast from Guaymas to Panama.

134. **Lythrulon opalescens** Jordan & Starks, n. sp. Plate xl.

Rather common in the estuary at Mazatlan, not yet noticed elsewhere; all the specimens of *Lythrulon* from other localities examined by us being referable to *Lythrulon flaviguttatum*.

Head 3½; depth 2⅔; dorsal XII, 16: anal III, 9; snout 3⅔ in head; maxillary reaching slightly past front of pupil, 2½ in head; orbit $2\frac{5}{8}$: interorbital 3⅔: longest dorsal spine 2; longest dorsal ray 4: second anal spine 2½; pectoral $1\frac{1}{18}$: ventrals 1½: scales 7–54–13.

Body deep, compressed, the back well elevated, the dorsal outline nearly uniformly curved from tip of snout to caudal peduncle: ventral outline curved from chin to breast, thence straight to anal spine, and slanting obliquely upwards to caudal peduncle.

Snout small and pointed; mouth small and oblique, the lower jaw slightly projecting; teeth all small, the outer scarcely enlarged; preopercle finely serrate, the posterior limb somewhat concave, the angle broadly rounded.

Gill-rakers short and slender, about half the diameter of pupil, 8–15: scales above lateral line arranged in oblique series: tip of snout, chin and maxillary naked; scales on head small and crowded; soft fins scaled.

Pectoral reaching to vent; ventrals reaching half way to second anal ray; second anal spine a little longer and stronger than third; upper lobe of caudal the longer, about equal to head.

Color as in *Lythrulon flaviguttatum*, in spirits, dark steel gray; a small very distinct pale spot on each scale of back and sides, surrounded by darker. This spot is, in spirits, light yellowish; in life of a pearly blue. Head plain; a small dusky blotch under angle of preopercle. Fins plain bright yellow in life. Young with a large black blotch at base of caudal, as in *Hæmulon steindachneri* and *Orthostœchus maculicauda*, and without the dusky horizontal streaks seen in most of the other species.

This species differs from *Lythrulon flaviguttatum* in having fewer gill-rakers, the depth and arch of the back greater.

Described from a specimen (No. 2963, L. S. Jr. Univ. Mus.) 9 inches long. Two others were obtained.

135. **Orthostœchus maculicauda** Gill.

This small species was not found at Mazatlan either by Dr. Gilbert or by the Hopkins expedition. Specimens yellow on posterior half; the back tinged with brassy olive, which grows darker behind, the posterior parts pretty distinctly yellow; fin spines gray, the soft fins olive, the fins growing dusky at tip; scales on back and sides each with a distinct black spot; iris yellow; scales above lateral line much enlarged, 4 in number, 7 in an oblique series; 52 pores.

The generally larger size of the scales above the lateral line may possibly separate this species from the common Atlantic form, *Anisotremus surinamensis*.

137. **Anisotremus cæsius** (Jordan & Gilbert).

This species is known only from two or three specimens obtained by Dr. Gilbert in 1881 from Mazatlan. It was not seen by us, and is doubtless rare.

138. **Anisotremus dovii** (Günther).

This species was found by Gilbert at Mazatlan and Panama, but no specimens were obtained by us.

139. **Anisotremus tæniatus** Gill. CATALINA.

This species is rather common about the islands. It reaches a length of about 18 inches, and in life is very brilliant in color. It is seldom found in shallow water. It ranges from Magdalena Bay to Panama.

140. **Pomadasis macracanthus** (Günther). BURRO.

This species is extremely common everywhere about Mazatlan. It is a food fish of some importance, but the flesh is rather coarse. It reaches a length of about 18 inches. When taken from the water it makes a loud and singular noise extremely similiar to the noise made by the donkey or burro, from which this species receives its common name. Every species of the genus makes some noise, but in no case is it so loud as in this one.

141. **Pomadasis branicki** (Steindachner).

This small species, rarely exceeding six inches in length, was found by us in some abundance in the Astillero at Mazatlan. It was obtained by Gilbert both at Mazatlan and Panama. Steindachner described it from Tumbez on the coast of Peru.

142. **Pomadasis panamensis** (Steindachner).

This species is generally common along the west coast, but it was not seen by us. Dr. Gilbert found it both at Mazatlan and Panama.

143. **Pomadasis axillaris** (Steindachner). BURRO BLANCO.

This species reaches the length of about a foot, and is occasionally taken at Panama; a single specimen being found by us at Mazatlan. Both Steindachner and Gilbert also record it from Mazatlan, and a single specimen has been found by us in the collection of Dr. Streets from the coast of Lower California. It has not been noticed from any other locality.

144. **Pomadasis nitidus** (Steindachner).

dachner) from *Pomadasis leuciscus* (Günther). We have reached the conclusion that all of these forms belong to one species, and that *elongatus*, as we have understood it, cannot be maintained as a separate species. The two supposed forms have been recorded from various places between Guaymas and Panama. The name *elongatus* was first applied to a Peruvian specimen, which is possibly different from *leuciscus*, as we have seen none exactly like Steindachner's figure.

The young show yellowish shades on fins. Second dorsal mottled with blackish; a diffuse dusky blotch on opercular angle, and evident dark streaks, three or four, along middle of sides.

146. **Orthopristis chalceus** (Günther).

This species is generally common along the coast from Guaymas to Panama. It was obtained by Steindachner and Gilbert at Mazatlan, but no specimens were secured by us.

147. **Isaciella brevipinnis** (Steindachner).

The original type of this species was obtained by Dr. Steindachner at Mazatlan. A specimen from Panama, now in the museum of Yale University, was obtained by Prof. Bradley. The species seems to be rare, and no specimens were secured by us.

148. **Microlepidotus inornatus** Gill. JOPATON.

Five specimens of this rare species, the largest about fifteen inches in length, were obtained by us with dynamite off the shore of the southernmost of the three Venados Islands.

In life, steel-blue, with stripes of bright bronze; upper fins with golden; caudal partly dusky; preorbital with vertically oblong spots.

Family SPARIDÆ.

149. **Calamus brachysomus** (Lockington). MOJARRA GARABATA.

This species is very common about Mazatlan, being a food fish of some importance and reaching a length of about fifteen inches. It was also obtained by Dr. Gilbert. Its range southward is not certain, but it is generally common in the Gulf of California.

Family KYPHOSIDÆ.

150. **Kyphosus analogus** (Gill). SALEMA.

This beautiful species is rather common about Mazatlan, both in the estuary and in deep water in the neighborhood of the islands. It was not found by Dr. Gilbert, and its range along the coast is not definitely distinguished from that of the following species, the two having been recorded as identical by authors who had seen but one. They were first properly distinguished by Jenkins and Evermann, who obtained both at Guaymas. The marked difference in color, however, does not appear in the description of Jenkins and Evermann, which was drawn anteriorly; scales 13–76–20; all the fins, with the exception of spinous dorsal, entirely scaled.

Tip of pectoral sharply rounded: front of anal not greatly elevated, its longest ray 3 in base of fin, which is about equal to head; spinous dorsal higher than soft dorsal; upper lobe of caudal the longer.

Color, steel blue, brighter than in *elegans*, with bronze streaks along the edges or rows of scales, much brighter than in *elegans*. A broader gray streak bordered with bronze at base of soft dorsal. A large brassy spot in the axil, extending along shoulder girdle; a deep bronze stripe through eye, another back from angle of mouth; the two separated by steel blue: fins all blue black, with some bronze, especially on pectoral. Body more elongate than in *elegans;* the form more elliptical: the mouth less blunt, with fewer teeth: the scales smaller and more crowded anteriorly; the fins lower, especially the anal. Well separated from *Kyphosus elegans*, living chiefly in the rocks outside: rare in the bay. Largest specimen eighteen inches long.

151. **Kyphosus elegans** (Peters). CHOPA.

This species is rather common about Mazatlan, especially in the sluggish waters of the Astillero. Like the preceding, it reaches a length of about fifteen inches.

Head 3⅔: depth 2: dorsal XI, 12; anal III, 11; eye 4 in head: snout 3¼; maxillary 3⅛; pectoral 1⅜, equals ventral; longest ray of soft dorsal 2½; longest dorsal spine 2½; longest anal ray 2: upper lobe of caudal equals head.

Body ovate, compressed: profile rounded, slightly produced before eyes: concave over snout in some specimens, straight in others: a gentle curve from eyes to dorsal. Mouth small, horizontal, the jaws equal: teeth in a single series, about 36 in each jaw; maxillary extending to the vertical from anterior edge of orbit; snout, lower jaw and preorbital naked, head everywhere else scaled; opercles with 8 or 9 rows of scales; scales on body large, somewhat crowded anteriorly; scales 11–63–17; all the fins, except spinous dorsal, with scales to their edges, those on caudal exceedingly small.

Tip of pectoral sharply rounded, not reaching to tips of ventrals; ventral spine half as long as soft rays; anal spines short and stout, graduated; anal elevated in front and higher than soft dorsal; middle spines of dorsal the longest, about equal to highest rays of soft dorsal; upper lobe of caudal the longer.

Color grayish black, with paler centers to the scales; sides with large faint diffuse yellowish white spots; a little bluish and yellowish on sides of head; a yellow streak below lower part of eye. Vertebræ 9+16 or 10+15.

Family SCIÆNIDÆ.

152. **Cynoscion reticulatus** (Günther). CORVINA.

Generally common on the sandy bottoms about Mazat-

154. **Larimus argenteus** (Gill).

One large specimen obtained; also found in the Gulf of California and southward on sandy shores to Panama.

155. **Larimus breviceps** Cuvier & Valenciennes.

Specimens of this species were obtained by Dr. Gilbert at Mazatlan, Punta Arenas and Panama. None were seen by us.

156. **Corvula macrops** (Steindachner). VACUOCUA.

One fine specimen from the Astillero at Mazatlan.

Head 3½; depth 3; dorsal XI, I, 25; anal II, 9; eye 3½ in head; snout 4¾; maxillary 2⅙; longest dorsal spine 1¾; longest dorsal ray 2¼; second anal spine 2⅓; ventrals 1½; pectoral 1⅗; caudal fin 1½.

Body oblong, moderately compressed, not much elevated; dorsal outline uniform from tip of snout to caudal peduncle; ventral outline rounded from chin to breast, then straight to anal spine, then slanting obliquely upward to caudal peduncle.

Snout blunt, shorter than large eye: upper jaw slightly projecting, teeth small and sharp, in one or two irregular series in lower jaw, in several series in upper jaw, the outer row slightly enlarged: maxillary extending to posterior edge of pupil: chin with four large pores; edge of preopercle covered with skin, which is serrated on the edge.

Gill-rakers slender, 9+13: scales ctenoid on the body, cycloid on the head: scales 8–56–11.

Spinous dorsal a little higher than soft dorsal: first dorsal spine very short, second about 5 times longer, third twice as long as second, third, fourth, fifth and sixth subequal, the others rapidly shorter: first anal spine very small, the second many times longer and stouter, but shorter than soft rays: ventrals inserted behind pectorals and reaching beyond them: caudal truncate.

Ground color silvery, but so closely set with small dark brown points as to almost obscure the silver; sides with about four faint dark cross bands and with conspicuous black stripes following the rows of scales, about 11 horizontal stripes below lateral line, those above slanting obliquely upward anteriorly, but becoming horizontal posteriorly, tips of ventrals and anal black, other fins dusky.

Described from a specimen 8 inches long.

157. **Bairdiella icistia** (Jordan & Gilbert).

This pretty species is not rare in the Astillero at Mazatlan, where specimens were obtained by Dr. Gilbert and by us. It has not been noticed elsewhere.

158. **Ophioscion scierus** (Jordan & Gilbert).

The species was obtained by Dr. Gilbert at Mazatlan; not seen by us. It is more common southward, having been taken by Dr. Gilbert at Punta Arenas and Panama.

159. **Micropogon ectenes** Jordan & Gilbert. VERRUGATO.

This species is a rather common food fish about Mazatlan, reaching a length of 18 inches. Numerous speci-

162. Menticirrus simus Jordan.

This species was described from specimens obtained by Dr. Gilbert at Mazatlan. A single very small one was obtained by us in the surf north of the city.

163. Menticirrus panamensis (Steindachner).

Taken by Dr. Gilbert at Mazatlan; not seen by us.

164. Menticirrus elongatus (Günther). VERRUGATA.

This species is very common in the surf on the sandy beaches about Mazatlan. Specimens were also obtained by Dr. Gilbert. Elsewhere it has been recorded only from Chiapam, whence came Dr. Günther's original types.

Family GERRIDÆ.

165. Eucinostomus californiensis (Gill). MOJARRA CANTILEÑA. (*Diapteris californiensis* and *gracilis* Gill.)

Excessively common in the estuary, being by far the most abundant species, not excepting the White Mullet. It is rarely used as a food on account of its small size, its length when adult ranging from five to ten inches. The second interhæmal bone in this species is developed in a very singular manner, being short, much expanded and hollow, the broadly open upper end being occupied by the posterior part of the air-bladder, the structure being the same as in the genus *Calamus*, but more highly developed, the bone being shorter and more largely excavated. This structure is seen also in *Eucinostomus gula*, *harengulus*, and probably others. As *Gerres gula* (= *argenteus*) is the type of the genus *Eucinostomus*, this structure may be held to define that genus as distinct from *Gerres*. There can be no question as to its generic importance. In *Gerres* proper, the second interhæmal is long and spear-shaped, very much more slender in proportion to its length, not hollow and not receiving any of the air bladder. This structure is seen in *Gerres cinereus* (Walbaum), in *Gerres peruvianus* Cuvier & Valenciennes, and in *Gerres lineatus* Humboldt, as also in several West Indian species.

Eucinostomus californiensis is generally common along the west coast of Mexico, from Guaymas to Panama. It is probably, however, not found in the West Indies, the closely related *Eucinostomus harengulus* being apparently a different species. The specimens called *californiensis* by Gill, having the premaxillary groove semi-oval or ∩-shaped, seem to represent the adult of this species. Those called *gracilis*, with the premaxillary groove linear, are the young or half-grown. Still others, especially adults, have the premaxillary groove round, forming a pit, and every intermediate character may be found.

At first we thought it possible to separate *californiensis* and *gracilis* as distinct species. The careful re-examination of some 200 specimens leaves us wholly unable to separate them, as all grades of variation occur. Appara substitute for *Gerres*, regarded as preoccupied by the earlier name *Gerris*, applied by Fabricius to a genus of insects. The name *Catochænum* can only be used if *Gerres* is regarded as ineligible. By the rules followed by us, *Gerres* must be retained, being spelled differently from *Gerris*. In different publications of Poey, *plumieri* is made the type of *Gerres*, although it is not one of Cuvier's original species. Bleeker substitutes *Diapterus* for *Gerres* and *Catochænum*, specifying *plumieri* as its type, while Gill and Poey have used the name *Diapterus* for the allies of *gula*, to which the name *Eucinostomus* had been applied in 1855 by Baird and Girard. Although *plumieri* cannot be made the type of *Gerres*, it seems to us that the cognate species *lineatus* can be so regarded. If this view is adopted, the restricted *Gerres* of the present paper would correspond exactly with the restricted *Gerres* of Poey and Gill. This fact certainly justifies us in choosing *lineatus* as the type of the genus.

There can be no doubt of the generic value of *Eucinostomus (gula)* and of *Ulæma* Jordan & Evermann MS. *(lefroyi)*, as distinguished from *Gerres*. Of the other groups represented in American waters, *Xystæma* Jordan & Evermann MS. *(cinereus)* seems to be a valid genus, while *Diapterus (auratus)* should stand rather as a subgenus of *Gerres*. *Diapterus* differs from *Gerres* chiefly in the entire preorbital. *Xystæma* has the preopercle as well as preorbital entire, while *Ulæma* has the second interhæmal very short, and the two spines of the anal are themselves scarcely enlarged.

Moharra Poey *(rhombeus)* differs from *Diapterus* only in the presence of two anal spines instead of three, a character of low importance, as the relation of the species included in the two groups is very close.

The exotic genera of this group have not been studied by us.

The specimens recorded by Eigenmann from San Diego Bay as *Gerres cinereus* var. (Amer. Nat., 1891, 156) seem to be *Eucinostomus californiensis*.

166. **Xystæma cinereum** (Walbaum). MOJARRA BLANCA.

Very abundant at Mazatlan, being one of the staple food fishes, and reaching a length of nearly two feet; its flesh is of an excellent quality. The species was found by Dr. Gilbert at Mazatlan and Panama, and seems to be generally common along the coast. Like the rest of the genus, it occurs in shallow water on sandy bottoms, away from the surf.

167. **Gerres peruvianus** Cuvier & Valenciennes. MOJARRA DE LAS ALETAS AMARILLAS.

This small species is abundant at Mazatlan, although less common than *Eucinostomus californiensis*, and *Xystæma cinereum*. It rarely exceeds six inches in length.

Gerres brevirostris Sauvage, from Rio Guayas, near Guayaquil, is not evidently different from this species.

168. **Gerres lineatus** (Humboldt). MOJARRA CHINA.
(*Gerres axillaris* Günther).

as by Dr. Gilbert. These small specimens are identical with those obtained by Xantus at Cape San Lucas, the types of *Cirrhites betaurus*. It has been supposed that these are the young of *Cirrhites rivulatus* Valenciennes, abundant about the Galapagos and Revillagigedos, as no differences except those of color appear. The color differences are, however, strongly marked, and we are disposed to let *Cirrhites betaurus* stand provisionally as a distinct species. The coloration of *betaurus* has been well described by Dr. Gill; that of *rivulatus* is well figured by Dr. Günther.

First dorsal fin bright orange red in life; second reddish; cross bands on body black.

Family CICHLIDÆ.

170. **Heros beani** Jordan. Mojarra Verde.

Common in the deeper and more quiet places in the Rio Presidio, especially just below the village of Presidio. It reaches a length of about eight inches, and is occasionally taken by the hook, its habits being very similar to those of the abundant sun fishes as seen in the more northern waters.

Adult light olive, banded with darker; black spots on each scale. First dorsal edged with dark red, the two black blotches and black bars obsolete. Young with the bars distinct; no blue, yellow or red in life.

Family POMACENTRIDÆ.

171. **Eupomacentrus rectifrænum** (Gill). Pescado Azul. (*Pomacentrus analigutta* Gill.)

This beautiful fish is very abundant in the rock pools about Mazatlan. It is excessively wary and hard to catch. Great changes in coloration, due to age, have been noticed by Dr. Günther and others. The chief peculiarity is in the greater uniformity in coloration of the adult, in which the blue shades become obscure, and the ocelli, so conspicuous in the young, are more or less lost.

This species is exceedingly close to *Eupomacentrus fuscus* (Cuvier & Valenciennes), a species found on the Brazilian coast. Comparing specimens from Bahia with ours from Mazatlan, we note that in *E. rectifrænum* the blue markings persist longer and that the scales on the head are smaller, more crowded and more mixed with small scales in *E. rectifrænum* than in *Eupomacentrus fuscus*.

Head 3⅓; depth 2; D. XII, 13; A. II, 11; scales 3–28–9; eye 4 in head; snout 2⅗; D. lobe 1⅖; C. upper lobe 1⅖; V. 1⅓; P. 1⅛.

Preorbital and preopercle strongly serrate. Teeth firm, flattened, not notched. Lateral line ending under ninth dorsal ray. Caudal lunate, the upper lobe the longer. Dorsal and anal rounded, ventral filamentous. Gill-rakers short, slender, weak, numerous.

Color of adult (5½ inches) nearly uniform blackish olive, darker on head, back and fins, paler on pectoral differences between the two are comparatively slight but very persistent, and we believe that the two species are fully distinct from each other. In life *Eupomacentrus flavilatus* is the most beautiful fish found on the coast of Mexico, showing a most intense shade in the blue of its back and the orange of its sides. Both this species and the preceding were found at Cape San Lucas, but only *Eupomacentrus rectifrænum* has been taken at Panama.

An irregular line from snout below eye to soft dorsal divides the fish into two parts; below this line all is brilliant yellow with an orange shade, deepest on anal; above all is the brightest sky blue. Scales darker, but all edged with sky blue, six sky blue stripes on upper part of head. An indigo spot on base of first soft dorsal and last dorsal spines extending on back, this surrounded by a ring of sky blue; a similar smaller ocellated spot on back of caudal peduncle.

173. **Abudefduf* saxatilis** (Linnæus).

Common in rock pools about Mazatlan, where it was obtained in abundance by Dr. Gilbert and by us. The largest specimens were taken by dynamite off the Venados Islands.

Careful comparison of these specimens with others from the West Indies shows no difference whatever. *Glyphisodon troscheli* Gill, the name given to the Pacific Coast form, is therefore fully synonymus with *Abudefduf* (or *Glyphisodon*) *saxatilis*.

In life, bright greenish yellow above with steel blue bands. Dorsal like back; other fins dusky; axillary spot faint.

In alcohol, the color is a slaty brown tinged with reddish brown below, showing faint dark cross bars, with no bright color anywhere, the yellowish green of the back being last to fade; behind the pectoral each scale has a white spot, these form white lines that run back to a little past the tip of pectoral. All fins dark except pectoral, which is colorless.

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* *Abudefduf* Forskål seems to be identical with *Glyphisodon* and is entitled to priority, notwithstanding its barbarous form.

174. **Abudefduf declivifrons** (Gill).

This species occurs in rock pools in abundance everywhere about Maxatlan, in company with *Abudefduf saxatilis*, from which its duller color readily distinguishes it.

In life, dusky brownish with many pale spots on edge of scales; these vary a good deal; cross bands blackish; no bright colors. Black spot at base of pectoral conspicuous, a good mark, varying in size, larger in older specimens.

175. **Microspathodon bairdii** (Gill). Plate xliii.

Numerous small specimens taken in the rock pools in company with *Eupomacentrus flavilatus*, a species which the present one closely resembles in color, and which scarcely excels it in brilliancy. This species has been well described by Dr. Gill. It seems to reach only a small

Body compressed, ovate; profile convex; mouth wide, lower jaw included; teeth in a single row and movable; gill-rakers small and numerous: head entirely scaled; scales on body large 3–30–9; scales running well up on fins; lateral line high, ending under last dorsal ray.

Color: Body divided into two parts by a line from the opercular flap to posterior end of soft dorsal, below this line it is rich, bright yellow, above it is sky blue, darker on head, with brilliant sky blue spots; a chain of these spots following the suborbitals below eye: a spot at angle of mouth, two converging lines of spots more or less run together from tip of snout to upper edge of orbit, each scale on nape with a spot and a few scattering spots on opercle; scales on upper part of body edged with dark; a dark spot on caudal peduncle anteriorly edged with sky blue; fins all more or less dusky except anal and ventrals, which are white and edged with black.

176. Microspathodon dorsalis (Gill). (*Pomacentrus quadrigutta* Gill.)

A single specimen 4 inches in length was obtained in a rock pool on the Peninsula called Vijia, by Mr. George B. Culver.

This specimen corresponds almost perfectly to Dr. Gill's account of *Pomataprion dorsalis*. A smaller specimen entirely similar was also obtained. The distinctions between this species and *Microspathodon bairdii* are constant though slight.

Head 3; depth 1⅝: D. XII, 16: A. II, 12; scales 3–28–10; eye 2½ in head; snout 4; D. lobe 1; C. lobe equals head; P. 1⅙; V. equals head.

Body compressed, the profile rounded, depressed before eye so that snout projects. Gill-rakers numerous, very short, slender, close set. Preorbital deep. Preorbital and preopercle entire. Teeth in a single row, movable.

Dorsal spines rising to the last, subtruncate, flattened, each with a brown vertical streak in center; the soft rays and lobes of caudal much produced, as also ventrals.

Deep indigo blue on body and fins; no pale edgings to any of the fins; three round sky blue spots above lateral line, the one near its beginning, the one under front of spinous dorsal, the third under last spine, the first smallest, the other two as large as pupil; a larger sky blue saddle in axil of last soft ray. Head with many sky blue spots everywhere, those on preorbital and suborbital coalescing in a blue streak; another streak behind angle of mouth, and another above eye. Axil sky blue, a bar of sky blue across end of snout. Angle of snout sky blue.

177. **Microspathodon azurissimus** Jordan & Starks n. sp. Plate xliv.

A surpassingly beautiful little fish, obtained by dynamite from the rocks about the Venados Islands. Three specimens were taken, the largest twelve inches in length.

This species seems to agree fully with *Microspathodon dorsalis*, except in coloration, in the greater elongation of the lobes of the fins and in the greater depth of the pre-

Head 3; depth 2; D. XII, 10; A. II, 13; eye 5 in head; snout nearly 2; pectoral 1½; highest dorsal spine 3 in body; ventral 2½ in length; anal lobe 2⅙; dorsal lobe 1¾ in body.

Body compressed and deep; dorsal outline from snout to caudal peduncle uniform; breast prominent and well rounded, behind which the ventral outline is straight to anal spine, then slanting obliquely upward to caudal peduncle. Mouth wide with thick lips; the teeth flat, sharp and movable, in a single row in each jaw, those in the upper jaw are arranged in a crescent, in the lower jaw they are in a straight line in front, but at the sides they describe nearly a right angle and run back; isthmus with a notch made by the prominence of the breast. Tip of snout, maxillary and lower jaw naked; head everywhere else with scales, the scales on cheeks in about 5 rows; scales on body large, 3–28–9; all the fins with scales. Accessory scales very few.

Lateral line running high and ending under last ray of soft dorsal; gill-rakers numerous, short and weak, about 5+21. Pectoral short and rounded at the tip; ventrals with the middle rays produced, 2½ times ventral spine, reaching past vent to anal; spinous dorsal low; with the exception of the first the spines are about equal; soft dorsal and anal falcate and filamentous, the dorsal lobe slightly the longer, not quite reaching to tip of caudal fin; caudal widely forked, the lobes falcate, the upper lobe the longer; the middle rays are contained 3½ times in the upper caudal lobe.

Specimens described twelve inches in length (Nos. 1610, 1636 and 2895, L. S. Jr. Univ. Mus.).

In life, deep indigo blue, with traces of olivaceous cross-shades. Pectoral, dorsal and caudal edged with bluish white. Eyes violet.

The species feeds on plants.

Family LABRIDÆ.

178. **Harpe diplotænia** Gill.

A single young female specimen was obtained by us at Mazatlan. This species is rare in collections, but is apparently not uncommon around the rocky islands. It has been recorded from Cape San Lucas by Xantus, and numerous specimens from the Revillagigedos have been taken by Dr. Gilbert. The form called *Harpe pectoralis* Gill is the male of the same species of which *Harpe diplotænia* Gill is the female.

179. **Pseudojulis notospilus** Günther.

This small species is common in rock pools about Mazatlan, where numerous examples, the largest about six inches long, were obtained by us. It was found in these pools by Gilbert, and has been recorded from Panama by Günther.

Coloration of adult blue green; bar across base of pectoral very bright; no dark spot behind eye; corners and tip of caudal pale, as in young. Each scale of posterior part of body with a small sky blue spot at tip; edges of adult. First dorsal bronze with bluish cross-streaks, the large black blotch ocellated with blue and with a patch of bright yellow before and behind it. Interspaces between this and the two other, smaller black spots also bright light yellow.

180. Halichœres dispilus (Günther). Plate xlv.

This beautiful little fish was found to be rather abundant in the branches of the Astillero which cross Isla de las Piedras south of Mazatlan. Unlike most species of the group, it lives on the muddy bottoms, and is abundant about the roots of the mangrove, which border the muddy branches of the Astillero. It reaches a length of about six inches. A few specimens were also obtained in tide pools with sandy bottom.

Head 3⅓; depth 4; dorsal IX, 11; anal III, 12; eye 6 in head; snout 3⅓; maxillary 4¼; pectoral 1⅔; anal 3; caudal fin 2.

Body slender and compressed; dorsal and ventral outlines similar; head pointed, the profile slightly convex; mouth small, the jaws equal; teeth in a single row; canines $\frac{2}{2}$ in front of jaws; at the posterior end of the premaxillary is a single strong, sharp tooth, pointing forward, and entirely below the angle of mouth. Lateral line high, following the curve of the back to the eighth dorsal ray, where it curves sharply down through two rows of scales, and then runs straight through middle of caudal peduncle to tail; pores of lateral line simple; scales large 2–27–10; head entirely naked; gill-rakers very small and pointed 6+7. Dorsal spines slender but pungent; caudal slightly rounded, the upper angle slightly acute; ventrals short not filamentous; scales before dorsal in about six rows, not covering middle line.

Length of specimen described, five inches. Number 2904, L. S. Jr. Univ. Mus.

In life olive green, a bright blue streak, narrow and somewhat interrupted, from eye to base of caudal; a broader dark bronze streak just below it, containing a series of small dark spots, mostly arranged in threes, the last one darkest, at base of caudal, just above middle line, these obsolete in adult; below the bronze band, a faint blue streak, then a broad brown one, then a short one, bright sky blue bounding the belly, ending over the middle of anal; belly and throat pearl white. Head cherry red and bronze anteriorly, becoming olive in all specimens behind, mottled with blue; a dark blue edged spot behind eye; a large black spot smaller than eye below fifth dorsal spine, the spot crescent shaped, bordered with yellow behind, mostly on one scale. Iris red. A golden crescent at base of pectoral. Dorsal bright orange, bluish below. Caudal cherry red. Anal bright orange. No spots on fins. Larger specimens deeper in color, the head cherry red, a dark spot bordered with blue behind eye. Pectoral not black. In alcoholic specimens pearly streaks appear on sides of head and behind pectoral.

Found by Dr. Gilbert at Mazatlan. Specimens have also been obtained at Panama by Günther, and at Acapulco

Family SCARIDÆ.

182. **Scarus perrico** Jordan & Gilbert. PERRICO.

This large parrot-fish is rather common about the rocky islands near Mazatlan. A single specimen was obtained by us. The original type was found by Dr. Gilbert at the same locality. The fins of another specimen were found on the beach at La Paz by Mr. James A. Richardson.

Body olive brown. The markings, fins, teeth and spots on head all bright blue green.

Family EPHIPPIDÆ.

183. **Chætodipterus zonatus** (Girard).

Occasionally seen at Mazatlan, several specimens being taken by us in the Astillero. It was found by Dr. Gilbert at Mazatlan and Panama. The original type of the species came from San Diego, where no author subsequent to Girard has seen it. It is probably generally diffused along the coast, although less abundant than the corresponding species (*Chætodipterus faber* L.) is in the Atlantic.

Chætodipterus zonatus agrees with *Chætodipterus faber* in nearly all respects. The chief differences are that behind the great band from soft dorsal to anal in *Ch. zonatus* there are two other bands; one under middle of soft dorsal, the other at base of caudal, both distinct complete rings; no other bands. The third dorsal spine is not very high, being only about half length of head, and about twice height of the fourth. Dorsal VIII–I, 18; anal II, 16; scales 70. Long rays of soft dorsal and anal ¼ longer than head.

Family CHÆTODONTIDÆ.

184. **Chætodon humeralis** Günther. MUÑECA.

Exceedingly common in the Astillero, especially on rock bottom. It reaches a length of about six inches, and is seldom used as food, although its striking color, which has suggested the name of *Muñeca* or doll, makes it an object of attention.

185. **Pomacanthus zonipectus** (Gill). MOJARRA DE LAS PIEDRAS. (*Pomacanthus crescentalis* Jordan & Gilbert.)

Not uncommon in rocky places about Mazatlan. Two specimens were obtained by us with dynamite about the wreck of a French man-of-war in the Astillero. Smaller specimens, very different in color from the adult, and hence taken by us to be a distinct species (*Pomacanthus crescentalis*), were obtained by Dr. Gilbert at Mazatlan and Panama. The original type of the species was taken at San Salvador by Capt. Dow.

Description of the adult of *Pomacanthus zonipectus:*

Head 3⅔; depth 1¼; D. XI, 23; A. III, 20. Preopercular spine longer than eye, 3⅓ in head. Last dorsal spine 1½ in head. Longest dorsal ray ¼ longer than

yellow, obscured by blackish centers of scales; behind this a diffuse blackish area; breast vermiculated with blue and yellowish; a blackish bar covering most of head, behind which the opercles and nape are yellowish; jaws pale bluish; dorsal orange, vermiculate with sky blue, the edge bright sky blue, below which is orange; caudal orange, vermiculated with sky blue, the edge orange, the very margin blackish. Anal blackish, vermiculated with sky blue; pectorals light orange, marked with grayish blue. Ventrals largely blue-black, tipped with orange, the spine bluish.

Family TEUTHIDIDÆ.

186. **Teuthis crestonis** Jordan & Starks n. sp. BARBERO NEGRO. Plate xlvii.

Common in the Astillero and in rocky places about the islands. Also obtained by Dr. Gilbert in 1881 at Mazatlan and Panama. These specimens having been destroyed by fire, have never been described, and were provisionally and incorrectly referred to the West Indian species *Teuthis tractus (bahianus)*, from which this species differs in a few respects.

Head 3⅓: depth 1⅝; D. IX, 26; A. III, 24; snout 1⅔ in head; eye 3⅓; pectoral equal to head; caudal ⅕ longer than head; longest dorsal spine equal longest soft ray, 1½ in head; ventral 1⅕ in head.

Body deep and compressed, the anterior profile steep, convex before eye; caudal lunate, the upper ray ⅓ longer than middle one, ventrals very long.

Body slaty brown, mottled with gray but without bands; dorsal with a bluish gray band at base, then a bronze one, forking on soft dorsal inclosing a bluish gray band; five gray bands and four bronze ones on dorsal more or less distinct, especially in young; anal with five bluish gray and five bronze bands more oblique than those on dorsal and hence not continuous the whole length of fin; caudal peduncle black, a whitish yellow cross-band behind spine, faint in adult, the anterior margin vertical, the posterior concave; rest of caudal black. Pectoral yellowish; ventrals dusky, the spine black.

Adult with the pectoral quite yellow; pale band at base of caudal growing faint with age; a blue streak along base of dorsal.

Numerous specimens, the largest about six inches in length, numbered 2899, in the L. S. Jr. Univ. Mus.

187. **Xesurus punctatus** (Gill). Cochinito. Plate xlvi.

Young specimens very abundant in rock pools about Mazatlan, hitherto known only from Cape San Lucas. It was not found by Dr. Gilbert at Mazatlan. Most of our specimens were secured by the use of the fish poison called gervo. By pouring this liquid into the rock pools at low tide this and several other species were obtained in numbers. This gervo or gerbo is the milky juice of a tree called *hava*, abundant in the forests about Mazatlan, but much smaller, scattered over posterior half of body; most numerous about the other spines. Gill-rakers extremely small and weak. Caudal evenly lunate. Pectoral not falcate; anterior profile concave before eye then convex, the short conic snout projecting; lower jaw included. Preopercle obliquely placed, its bony edge slightly roughened.

Color in life olive green, slightly paler below, everywhere evenly covered with small round black spots, close-set and not confluent, the largest about equal to nostril. Caudal peduncle and fin abruptly bright yellow, unspotted. Other fins colored like the body and similarly spotted, the spots more sparse, the edges dusky with few spots. Large caudal spines whitish, their bases black; other spines all black.

Among the young two different styles of coloration were noticed, but all probably belong to the same species:

1. Specimens with the caudal yellow are more dusky, the dark spots much smaller and more distinct than in the others. Ground color of back light steel blue gray, lighter below head. Caudal canary yellow, clouded with dark at base, the yellow running forward on caudal peduncle.

2. Specimens with the caudal white have ground color lighter, more milky in general, much more silvery below eye, the silvery forming an irregular triangular patch on breast and opercle; caudal gray and white, black at base, white running forward slightly on caudal peduncle; dark spots on body forming pale reticulations, above lateral line white patches. Body deeper than in yellow-tailed specimens.

Both have the first dorsal and anal black at base, otherwise mostly white; white line bounding the back; dark bar from nape to eye; snout dusky; breast and opercles silvery.

This species is the type of the genus *Xesurus* Jordan & Evermann (MS.), distinguished from *Prionurus* by the armature of the caudal peduncle, as above described.

Family BALISTIDÆ.

188. **Balistes polylepis** Steindachner. PEZ PUERCO.

Generally common in rocky places on the coast from Magdalena Bay to Panama. Many specimens were obtained by us, the largest of them sixteen inches in length. It was found at Mazatlan also by Gilbert and by Steindachner.

189. **Balistes naufragium** Jordan & Starks n. sp. PEZ PUERCO DE PIEDRA.

Four specimens obtained with dynamite, about the wreck of a French man-of-war in the Astillero at Mazatlan, in company with *Pomacanthus zonipectus*. The largest of these was fourteen inches in length.

Allied to *Balistes carolinensis*.

Head 3; depth $1\frac{4}{5}$; D. III–27; A. 24; scales 50; 12

largely pale blue, especially toward the tail; faint traces of numerous dark cross-bands. Fins dusky olive, the pectoral and first dorsal paler, base of pectoral dusky.

Type No. 1656 L. S. Jr. Univ. Mus.

190. **Pachynathus capistratus** (Shaw). COCHE.

Common in rocky places about the islands of the Ven ados, Creston and Isla Blanca; many specimens obtained. This species was found by Gilbert at Mazatlan, and by Steindachner at Cape San Lucas. We have thus far been unable to find any distinction between the American form and the common East Indian species, to which the name *capistratus* was first given. Two markedly different types of coloration were obtained, supposed by us to be of the two sexes, since no other difference except that of coloration is noticeable. In all specimens obtained, however, the sexual organs were so immature that the sexes could not be distinguished thereby.

Specimens supposed to be female dull olive with darker clouds; no yellow on posterior parts which are scarcely paler behind; fins all plain olive blackish; streak behind mouth light bluish, very faint, soon fading after death; lower lip blue, then golden, then a blue ring, then yellow, then bluish; upper lip livid, bluish above.

Others supposed to be male are in life dark olive clouded with darker; posterior part of body deep yellow, below median line; fins blackish; first dorsal bright olive yellow on membranes; green on caudal membranes, the rays black. Anal reddish. Streak behind mouth bright red in one specimen, whitish in another. Upper lip livid blue then orange, then golden, then livid blue or purplish, then orange, then crimson, then dark.

Still other specimens were marked with whitish shades instead of red.

Family TETRAODONTIDÆ.

191. Spheroides annulatus (Jenyns) var. *politus* Girard. TAMBOR.

Very common everywhere in the Astillero. Specimens entirely smooth, and those variously prickly, were obtained; prickly ones, both young and old, were found, but no very young which were smooth. There seems to be no specific difference recognizable among these. All of them, however, differ from specimens taken farther south in the larger size of the dark spots and in a somewhat greater tendency to smoothness of the body. All of these, smooth or rough, seem to belong to the form called *politus*, which is probably the northern form or representative of *Spheroides annulatus*.

192. Spheroides lobatus (Steindachner). BOTETE.

Rather common in the estuary with the preceding, reaching a smaller size, the largest seen not over six inches in length. The species was first described by Steindachner from Altata, but until its recent discovery in the Albatross collections it was confounded with *Spheroides angusticeps* (Jenyns), from which it is prob-

Family DIODONTIDÆ.

193. **Diodon hystrix** Linnæus. PUERCO ESPINO.

Very common about rocky places, especially among the islands, where it was also found by Dr. Gilbert. All specimens taken belong to the typical *Diodon hystrix*. *Diodon holocanthus*, if different, is unrepresented in our Mazatlan collections.

Family MOLIDÆ.

194. **Mola mola** (Linnæus). PEZ MOLA.

Found in the open sea from San Francisco to Mazatlan. It was seen at the latter locality by Dr. Gilbert, but not by us.

Family SCORPÆNIDÆ.

195. **Scorpæna mystes** Jordan & Starks, n. sp. LAPON. Plate lii.

Common in the Astillero, on the bottom. Very tenacious of life, and much dreaded by the fishermen from the poisonous sting of its dorsal spines.

Allied to *Scorpæna plumieri* Bloch, which species it represents on the Pacific Coast.

Head 2⅓; depth 3⅓; dorsal XII, 10; anal III, 5; scales about 30; orbit 6½ in head; maxillary 2; pectoral 2; highest dorsal spine 3½; second anal spine 3; caudal 2.

Body robust, not much compressed; interorbital space wide, not deeply concave, ½ wider than orbit; a pit between preorbital and eye, and a broad depression behind coronal spines; membranous flaps on preorbital, edge of preopercle, over nostrils and above eyes; preocular, supraocular, tympanic, coronal, occipital, nuchal and exoccipital spines present. Maxillary reaching to behind eye; lower jaw included; gill-rakers short and thick, about

3+6; head naked, with the exception of a few imbedded scales on preopercle and posterior part of opercle; scales on body large, many of them with membranous flaps.

Olive-brown almost black, marbled with light drab; opercular flap with pale edge; the fins much spotted and marbled, all except spinous dorsal, with white margin, more distinct in the young; caudal fin showing three indistinct cross-bars; axil jet black, with white spots.

Largest specimen fourteen inches long.

This species differs from *Scorpæna plumieri* in having a wider and flatter interorbital area; the lower jaw wider and more rounded in front; the knob at symphysis not so sharp and projecting; the pit behind coronal spines broader and not so deep, and the color darker.

This species was also obtained at Mazatlan by Dr. Gilbert, who identified it provisionally as *Scorpæna plumieri*.

Types numbered 1501, 1616, 1617, 2919 on the L. S. Jr. Univ. Mus. register.

196. Scorpæna sonoræ (Jenkins & Evermann).

This small species is not uncommon in the Astillero, where numerous specimens, none of them over three

Family GOBIIDÆ.

198. **Philypnus lateralis** Gill. ABOMA DE MAR.

Common in the Rio Presidio and occasionally taken in the Astillero, especially where the fresh water soaks into it. The species is common in fresh waters along the coast, but has not hitherto been noticed at Mazatlan.

199. **Dormitator maculatus** (Bloch). PUÑECA.

Rather common in the Rio Presidio and also in the brackish waters about the estuary. The young occur in considerable abundance in the mud puddles left by the winter rains or by the high tides. It reaches in the river a considerable size, and is a food fish of some importance, said to be the most valuable in the Rio Presidio. It is generally common along the coast, as well as everywhere along the Atlantic side.

200. **Eleotris æquidens** Jordan & Gilbert. GUAVINA.

Rather scarce in the Rio Presidio, where only one young specimen was obtained by us. A few others were found in brackish waters or muddy places about the estuary.

Blackish everywhere, sides with faint whitish streaks, along rows of scales; a broad blackish lateral band occupying whole of side; back and belly paler; traces of faint dark cross-bands; caudal black, with a pale margin and some dark cross-shades; pectorals, dorsals and ventrals more or less barred with black; a whitish bar at base of caudal with a darker one before it. Scales 68; preopercular spine well developed.

201. **Cotylopus gymnogaster** (Ogilvie-Grant).

Recorded from streams about Mazatlan; not seen by us.

202. **Awaous tajasica** (Lichtenstein). ABOMA DE RIO.

Found in company with *Philypnus lateralis*, from which most fishermen scarcely distinguish it. It is rather less abundant in the river, and was not noticed by us in the Astillero. Elsewhere on the coast it has been recorded only from the river at San José del Cabo in Lower California, where it was found by Mr. Lyman Belding and more recently by Dr. Gustav Eisen.

Comparison with specimens from Havana shows no differences.

203. **Gobius soporator** Cuvier & Valenciennes. CAIMAN.

Found in abundance in all rock pools, ascending farther above the low-tide mark than any other marine species. It does not occur in fresh water. There seems to be no difference between these specimens and those from the Gulf of Mexico, where it is found everywhere in water not exceeding two feet in depth.

204. **Gobius sagittula** (Günther).

A few small specimens, not over four inches in length, slender, some filamentous; caudal lanceolate; teeth sharp, rather small, the outer larger; lower jaw thin and flat, its acutish tip elevated.

Olive, speckled and marbled; side with five oblong black spots, the smallest at base of caudal; a black blotch on opercle; dark cross-bars under soft dorsal; head much mottled; dorsal speckled; caudal with ten zigzag cross-bars of dark specks; pectoral faintly barred; anal and ventral plain; a dark curved streak about yellowish base of pectoral; lower lip dusky; a blackish cross-blotch above gill opening.

In the adult, called *Gobius longicauda*, the caudal is much longer, but there is no other difference of importance.

205. **Gobius manglicola** Jordan & Starks n. sp.

One specimen found in the mud of the Astillero among the roots of mangrove bushes (*Rhizophora mangle*).

Head 4¼; depth 5⅔; D. VI–12; A. 12; scales about 35, not to be exactly counted; caudal lanceolate, 2⅔ in body; pectoral about equal to head; dorsal spine slender, not filamentous, 1⅔ in head; eyes large, close together, the range partly vertical, the narrow interorbital deeply furrowed; no flaps on shoulder girdle; scales moderate, ctenoid anteriorly, becoming smooth behind; median keel on head slight; head naked.

Body long, compressed, the head depressed, the cheeks tumid; snout bluntly truncate; mouth large, the maxillary reaching the middle of eye, not produced backward, truncated behind, somewhat oblique, the lower jaw a little the longer; lower jaw flat; teeth strong, the outer in both jaws enlarged; cranium without median crest, abruptly widened behind eyes.

Color light olive mottled with darker; six oblong blotches of blackish on sides as in *Gobius boleosoma*, the last at base of caudal; dorsals and caudal finely checkered and barred with dark brownish orange and blackish; anal mottled; a dark shoulder spot; a dark bar before eye and one below eye; ventrals dusky, the edge pale.

The species seems nearest allied to *Gobius sagittula.*

One specimen, 1½ inches long, numbered 3095 on the L. S. Jr. Univ. Mus. register.

206. Garmannia paradoxa (Günther). Plate xlix.

A single specimen found on muddy bottom among the mangroves lining the estuary.

Head 3½; depth 4⅓; D. VI–11; A. 9; eye 4 in head; snout 4¼; pectoral 1⅙ in head; dorsal spine 1⅛.

Form of *Gobiosoma bosci.* Body compressed; head broad and depressed, with tumid cheeks; snout not very blunt, short, oblique-truncate; eyes rather large, high, the maxillary not produced, extending to their posterior margin; mouth large, oblique; lower jaw heavy, slightly projecting; teeth strong; gill-openings narrow, not wider than base of pectoral. First dorsal rather high, the first spine filamentous, reaching past soft dorsal; other fins low. Head and anterior half of body to front of soft dor-

Skull without median crest. Interorbital space not concave. Head not very abruptly widened behind eyes.

One specimen 1½ inches long obtained. This specimen differs but slightly from Günther's account of *Gobius paradoxus*, a species which is the type of the genus *Garmannia* of Jordan & Evermann (MS.), distinguished from *Gobius* by the half-naked body. The genus is named for Mr. Samuel Garman, the accomplished ichthyologist of the Museum of Comparative Zoology at Cambridge, Massachusetts, in recognition of his important contributions to ichthyology.

207. **Aboma etheostoma** Jordan & Starks, n. gen. and n. sp. Plate 1.

A single small specimen found in the mud on a shallow bottom in the Astillero.

ABOMA, new genus, allied to *Microgobius* Poey, distinguished by the large, ctenoid scales, which cover the body; head naked, rather long, pointed in profile, the mouth moderate, not very oblique; teeth rather strong. Dorsal spines more than six, none of them filamentous; soft dorsal and anal short; no flaps on shoulder girdle. Cranium with a slight median crest. The name *Aboma* is used by the Mexicans in Sinaloa as synonymous with goby. Besides the new species, *Aboma etheostoma*, which is the type of this genus, probably *Gobius chiquita* Jenkins & Evermann, and *Gobius lucretiæ* Eigenmann & Eigenmann, will be referable to it.

Head 3⅓; depth 5; D. VIII–11; A. 10; scales 26; longest dorsal spine 1¾ in head; eye 3; snout 4; maxillary 3.

Body long and low, moderately depressed and pointed forward. Scales large, ctenoid behind, none on head, those on nape and belly much reduced. Mouth moderate, terminal, moderately oblique; the maxillary reaching middle of pupil, jaws subequal or the lower a little the longer; teeth rather strong. No flaps on shoulder girdle. Cranium with a slight median crest. Interorbital ridge not hollowed out; skull not abruptly widened behind.

Color olivaceous, side with a very broad jet black lateral band, three times interrupted by silvery. Caudal white with four < shaped bands, growing progressively fainter behind. Pectoral mottled gray, with a jet black oblique crescent towards its base, surrounding a large yellow spot, side of head with four round gray spots separated by black, the largest below eye, with a black streak before it. First dorsal jet black; second mottled; the produced spine with yellowish. Ventrals and anal pale.

One specimen, 1⅛ inches long, in the Museum of the Leland Stanford Jr. University.

208. **Evermannia zosterura** (Jordan & Gilbert). Plate li.

Very common on sandy bottoms everywhere about the estuary, numerous specimens being dug out of the sand by Mr. Williams. It is seldom found much if any below

Male sometimes with traces of eight olive cross-bands. Fins very ornate, the dorsal and anal yellowish at base, then a broad median band of jet black, then a broad white margin. Middle of caudal yellow to the tip, with a black band above and below, and a white edge above and below this as in dorsal and anal; no bands on tail.

Female with dorsal filament short, reaching about to first soft ray. Dorsals and anal checkered with blackish; caudal faintly barred; all vertical fins with pale edgings, but without the black stripe of the males.

Family GOBIESOCIDÆ.

209. **Gobiesox adustus** Jordan & Gilbert.

Obtained by Dr. Gilbert in rock pools at Mazatlan. Rare and not found by us.

210. **Gobiesox erythrops** Jordan & Gilbert.

Found rare in rock pools at Mazatlan by Dr. Gilbert, who also records a specimen from Tres Marias. Not seen by us.

211. **Gobiesox zebra** Jordan & Gilbert.

Very abundant in rocky places at Mazatlan, especially among sea urchins. Numerous specimens were obtained by us, as also by Dr. Gilbert.

The coloration is quite variable, although the markings are rather constant. In general, light pink with markings of gray, blackish and olive; a distinct dusky blotch behind eye and a dark bar across caudal.

212. **Gobiesox eos** Jordan & Gilbert.

Found in rock pools at Mazatlan by Dr. Gilbert. Not recorded from any other locality.

Two specimens obtained by us from rock pools among echini. The bright cherry red coloration is distinctive and persists in alcohol.

Family OPISTOGNATHIDÆ.

213. **Opistognathus punctata** Peters,

The original type of this species was described by Dr. Peters from Mazatlan. It was also found by Dr. Gilbert at Panama, the two specimens mentioned being as yet the only ones known.

Family BLENNIIDÆ.

214. **Isesthes brevipinnis** (Günther).

This species was found to be rather common in rock pools at Mazatlan both by Dr. Gilbert and by us.

215. **Rupiscartes atlanticus** (Cuvier & Valenciennes.)

This species is very common in rock pools about Mazatlan, where it reaches a length of about six inches. It was found in numbers by Dr. Gilbert at Mazatlan, but has not been recorded from localities farther south. Mr. Charles H. Townsend found it at San Cristobal Bay, and Mr. John Xantus at Cape San Lucas. Thus far no difference has been found between these specimens and those from the West Indies.

about the same size. It was also found by Richardson at La Paz and by Gilbert at Mazatlan. It has been recorded from Cape San Lucas by Xantus and from San Cristobal Bay by Townsend. The Pacific form called *Labrosomus xanti* seems to be scarcely if at all distinguished from the West Indian form, *nuchipinnis*, cognate to it. The only difference we have found is in the dentition of the vomer, and this may not be constant.

218. Labrosomus delalandi (Cuvier & Valenciennes).

Extremely common in rock pools at Mazatlan, where it was also found by Dr. Gilbert. It has not been noticed from any other locality on the Pacific Coast. Thus far we have not been able to distinguish it from *Labrosomus delalandi* of the coast of Brazil.

219. Enneanectes carminalis (Jordan & Gilbert), n. gen. Plate [illegible].

Four specimens, types of the species, were found by Dr. Gilbert in a rock pool at Mazatlan. A single small example was obtained by us.

The short [illegible] body, large rough ctenoid scales, little rounded profile, and [illegible] distinguish this species sufficiently from *Tripterygion* [illegible], and characterize the new genus *Enneanectes* [illegible] Jordan & Evermann.

220. Auchenopterus monophthalmus Günther.

Several specimens taken in rock pools at Mazatlan. At low tide it is often [illegible] in which case [illegible]

In this species [illegible] separated from [illegible] species. *Auchenopterus* [illegible] constant [illegible]

Family FIERASFERIDÆ.

221. Fierasfer arenicola Jordan & Gilbert.

A single specimen found in the sand at Mazatlan by Dr. Gilbert. At first described as a new species, *Fierasfer arenicola* Jordan & Gilbert, and subsequently identified with the species which occurs in more or less abundance in the shells of the pearl oyster. It was not found by the Hopkins Expedition. According to Prof. Putnam, the West Coast species, *Fierasfer arenicola*, is not distinct from *Fierasfer dubius* Putnam, of the Florida Keys. We may, however, retain the former as distinct until comparison of specimens can be made.

Family BROTULIDÆ.

222. Dinematichthys ventralis Gill. Plate liv.

Found abundant in rock pools at Mazatlan, where specimens were taken reaching a length of about four inches. This fish has hitherto been recorded as extremely rare, and very few were obtained by Dr. Gilbert. This is one of the species that were brought from their hiding places by the introduction of the poisonous juice

224. **Citharichthys gilberti** Jenkins & Evermann. LENGUADO.

Very common everywhere in the Astillero, and also ascending the Rio Presidio in the fresh waters nearly as far as the village of Presidio. In fresh water the color is considerably brighter than in the sea, and these fresh water specimens correspond to those described by Jordan & Goss as *Citharichthys sumichrasti*. These seem to be, however, of the same species.

225. **Azevia panamensis** (Steindachner).

Common in the Astillero, reaching a length of about eight inches. The following is a count of the fin rays of nine specimens: D. 95, A. 75; D. 89, A. 67; D. 92, A. 71; D. 89, A. 71; D. 94, A. 74; D. 89, A. 71; D. 90, A. 72; D. 92, A. 71; D. 91, A. 72.

These specimens seem to be inseparable from *Azevia panamensis*.

226. **Etropus crossotus** Jordan & Gilbert.

Rather common in the Astillero with the preceding species, but reaching a smaller size, rarely exceeding four inches. On careful comparison of our specimens with others from Beaufort, Pensacola, Panama, and other localities, we are unable to find any differences. The color varies with the bottom, some being plain light brown, others are much mottled with lighter or with darker.

227. **Hippoglossina macrops** Steindachner.

This species was described by Steindachner from a specimen obtained at Mazatlan. We have not seen it.

228. **Paralichthys adspersus** (Steindachner).

Very common in the bay and Astillero at Mazatlan, and in fact everywhere on the coast from Guaymas and

La Paz to Panama and Callao. It reaches a length of about three feet, and is a food fish of some importance, most specimens, however, being much smaller.

Head 3½; depth about 2 in length of body; D. 73 (70 to 76); A. 57 (53 to 60); P. 12; V. 6; scales on lateral line about 106+8 with 35 dorsally and 36 ventrally.

Flesh firm. Body oblong, moderately compressed; mouth large, oblique, the mandible very heavy, slightly projecting; 4 canine teeth on each side of lower jaw in adult specimens, 8 in young, the two anterior teeth long; anterior teeth of upper jaw strong, but smaller than those in the lower jaw; the lateral teeth very small and close set. Eye small, shorter than snout, about 7 (6 to 8) in length of head; interorbital area, smooth, flattish, ⅔ width of eye. Scales cycloid, small anteriorly and larger posteriorly. Lateral line strongly arched anteriorly, arch about 3⅓ in straight part.

Gill-rakers of medium length, broad, retrose-serrate on inner side, longest about ⅔ length of eye, from 4+13 to 5+14 in number, counted in eight specimens; pectoral fin about as long as mandible, slightly more than half

These specimens seem to be identical with *Paralichthys adspersus*, described from Callao by Steindachner. The original types have on the average more gill-rakers than we find on our Mazatlan specimens, but this character is subject to variation, and no other distinction appears.

In one of Dr. Steindachner's types from Callao (11,417, Mus. Comp. Zool.) we find the gill-rakers longer, 6+17; depth 2½ in length; D. 67; A. 51; scales 120; arch of lateral line barely twice as long as high, nearly 5 in straight part; maxillary 2⅙ in head.

Mr. Garman has kindly examined for us six other specimens, with the following results:

"*Paralichthys adspersus* from Callao has gill-rakers—

$\frac{7}{17}$ above, as long as the eye;
below.
$\frac{5}{15}$ about ⅔ as long as the eye.
$\frac{7}{18}$ nearly as long as the eye.
$\frac{3}{14}$ about ⅔ as long as the eye.
$\frac{5}{15}$ about ⅔ as long as the eye.
$\frac{6}{17}$ near ¾ as long as eye."

—(Garman, in lit., May 3, 1895.)

Family SOLEIDÆ.

229. Achirus mazatlanus (Steindachner). LENGUADO DE RIO. (*Solea pilosa* Peters.)

Very abundant in the fresh waters of the Rio Presidio below the village, varying considerably in color, and somewhat in form. One specimen was taken in the brackish waters of the estuary.

230. Achirus fonsecensis (Richardson).

Two specimens found in the Rio Presidio with *Achirus mazatlanus*; not seen at Mazatlan.

231. Symphurus williamsi Jordan & Culver, n. sp. Plate lv.

Two specimens, the largest about 1½ inches long, were obtained by Mr. Thomas Marion Williams in tide pools with sandy bottom, in very shallow water, near the estuary at Mazatlan.

Head 4⅘; depth 3⅔; D. 93; A. 73; scales 92. Body slenderer than in *Symphurus plagiusa*, which it much resembles, but not so slender as in *Symphurus elongatus*, and the caudal fin not black. Upper eye slightly in advance of lower.

Sand color in life; light gray, everywhere finely mottled with light and dark, with traces of a few very narrow dark-cross bands. Fins all mottled; the caudal and posterior part of dorsal and anal not black, scarcely darker than anterior part.

Type numbered 2943, in the register of L. S. Jr. Univ. Mus.

Family ONCOCEPHALIDÆ.

232. Oncocephalus elater (Jordan & Gilbert).

SUPPLEMENTARY NOTE ON THE FISHES OF LA PAZ HARBOR.

Mr. James A. Richardson, a member of the Hopkins Expedition, spent two days at La Paz, the chief city of Baja California, where he made a small collection of fishes. The work was done under very unfavorable conditions, as La Paz has no fish market and its fish supply is obtained by the spear and the hook and line. There is but one seine at La Paz, a very old and rotten one, which was rented by Mr. Richardson, as was also a parachute seine and a small dip-net. Considering all the difficulties encountered, the list here given shows that the locality is well worthy of a detailed exploration.

Concerning the harbor of La Paz, Mr. Richardson has the following notes:

"The approach to La Paz estuary is guarded by several large islands, uninhabited, wild and precipitous. The entrance to the estuary is very wide, apparently ten or fifteen miles, the general direction being north and south and the length of the estuary about fifteen miles. The estuary gradually narrows to about one mile at ten miles from the entrance. As the steamer proceeds up the estuary it is noticed that she hugs the left bank closely. I was told that in all that breadth of water there is but a very narrow channel, the balance of the space in the estuary being of a sand formation, the sand bars coming very near the surface of the water so that they can be seen from the deck of the steamer. The steamer in following the channel nearly doubles on itself occasionally, and in the darkness of the night a boat is lowered and a search is made for certain buoys. The left bank is made up alternately of gravel beach and abrupt cliffs all the way to La Paz. The country behind La Paz is hilly and mountainous, of no value, covered with rocks and cactus. The right bank opposite La Paz, as far as one could see, is one vast stretch of sand and mangrove bushes lying a little above tide water. This is considered to be fine soil for cocoanut trees, but it is uninhabited and uncultivated. The sand beach is very fine; one could ride a bicycle here for fifty miles following the shore line.''

1. **Narcine entemedor** Jordan & Starks.

Common. One specimen somewhat decayed found on the beach.

2. **Opisthonema libertate** (Günther).

Two specimens obtained (1¾ in. long).

3. **Stolephorus ischanus** Jordan & Gilbert.

Two small specimens.

4. **Stolephons curtus** Jordan & Gilbert.

One specimen.

5. **Mugil cephalus** Linnæus.

Very common.

6. **Mugil curema** Cuvier & Valenciennes.

Very common.

12. **Xenistius californiensis** (Steindachner).

Several young specimens obtained.

Silvery, with continuous streaks of bright warm brown along the rows of scales.

13. **Pomadasis macracanthus** (Günther).

Common.

14. **Orthopristis reddingi** Jordan & Richardson, n. sp. Plate xli.

Allied to *Orthopristis ruber* (Cuv. & Val.)

Head 3⅙; depth 3; dorsal XII, 15; anal III, 10; scales 8–52–15; 53 pores.

Eye 4¼ in head; maxillary 3¼; preorbital 4¼ in snout; pectoral 1⅔ in head; longest dorsal spine 2⅚; longest soft ray 3⅗; second anal spine 4⅔; ventral 1⅔; upper caudal lobe 1½; base of soft dorsal in spinous 1¾.

Body oblong, the back not much elevated; the anterior profile straightish, slightly depressed above the eye; mouth small, low, the maxillary reaching to opposite the nostril; teeth subequal, in broad bands; lower jaw included; nostrils both oblong, the anterior the larger; eye rather large, about as wide as the broad preorbital; preopercle very finely serrated on its posterior margin only, the serrations very weak; gill-rakers short and small, about 12; scales moderate, the rows above lateral line very oblique, those below nearly horizontal, the series from the scapular scale reaching middle of spinous dorsal. Spinous dorsal moderate, not deeply notched, the median spines injured in youth in the type specimen; soft dorsal low, free from scales: anal spines low, the second a little longer than third; soft rays scaleless; caudal lunate, the lobes unequal, the upper longer than lower, which is more obtuse. Ventrals rather long, inserted just behind axil of pectoral. Pectoral rather short, not quite reaching tips of ventrals.

Color pearly gray, darker above; each scale of back and sides, with a bright bronze spot behind its center; these forming nearly continuous streaks along the rows of scales. These streaks run upward and backward anteriorly and nearly horizontally on sides, when they are more or less interrupted or transposed. Head plain gray, dorsal with some streaks and clouds; outer fins plain; ventrals somewhat dusky.

One specimen, 8¾ inches long, was taken by Mr. Richardson.

This species is very closely allied to the Atlantic species, *Orthopristis ruber* (Cuv. & Val.), but has the body a little more slender and the head larger.

The specimen from Guaymas provisionally referred to *Orthopristis cantharinus* (see Jordan & Fesler. Rept. U. S. Fish Com. for 1889 to 1891, 500, 1893), is perhaps a second specimen of *Orthopristis reddingi*.

This species is named in honor of Hon. Benjamin B. Redding, first Fish Commissioner of California, a man deeply interested in scientific research, to whom Mr. Richardson has been indebted for many favors, in his

19. **Xystæma cinereum** (Walbaum.)

Common. About twenty specimens obtained.

20. **Gerres lineatus** (Humboldt).

Common.

21. **Scarus perrico** Jordan & Gilbert.

One specimen, found dead on the beach.

22. **Spheroides lobatus** (Steindachner).

Common. Two specimens obtained. In color these approach *Spheroides angusticeps* (Jenyns). It may be that *lobatus* is, after all, the young of *angusticeps*, as was supposed by Jordan and Gilbert.

23. **Diodon holacanthus** Linnæus.

Common. One specimen, 11 inches long, was obtained. D. 12; A. 12: back and sides covered with spots; no spots on fins or tail; back very dark; a dark band between eyes; frontal spines nearly as long as pectoral spines which are longest.

24. **Alexurus armiger** Jordan, n. g. and sp. GOBIIDÆ. Plate xlviii.

Head 4⅔; depth 8; dorsal VI–13; anal 11; V. I, 5; scales about 102–30; eye 8 in head; maxillary 2⅔; mandible 2½; snout 5⅔; interorbital 4⅓; pectoral 1⅘; caudal equals head; ventral 2; last dorsal ray 1⅗.

Body long and low, compressed posteriorly, depressed in front. Head flattish and broad above, the cheeks moderately tumid. Eyes small, high up, separated by a broad flattish interorbital space: snout short; mouth moderate, very oblique, the maxillary ceasing below the center of pupil; lower jaw very heavy, oblique, projecting beyond upper, its outline horseshoe-shaped, obtuse in front. Teeth in rather broad bands, the outer enlarged below, but scarcely so above; none of them canine-like. Top of head with very small scales. Cheeks and opercles with rudimentary scales above. Preopercle with a concealed antrose hook below as in *Eleotris*. Scales on body very small, perfectly smooth, partially imbedded; scales on nape and throat minute. Gill membranes extending a little forward below, so that the branchiostegals are free from the isthmus.

Insertion of dorsal twice as far from middle of base of caudal as from tip of snout; the fin low, its slender rays slightly filamentous. Soft dorsal low, its last ray highest. Anal similar, beginning under second dorsal ray. Caudal long, bluntly pointed behind, with strongly procurrent base above and below, the base above two-fifth length of head formed of fourteen short rays, that below a little shorter, of twelve rays, this procurrent portion forming an angle with the caudal proper where it joins it. Pectoral and ventrals short, the ventrals inserted under pectorals.

Color olive green, dusky above, paler below, but everywhere covered with fine black dots. Both dorsals with the membranes pale, the rays each barred with black. Caudal mesially blackish, all the rays barred or chequered

25. **Gobius sagittula** (Günther).

Two large specimens, each six to eight inches long, besides one very young example, corresponding to the form called *Gobius longicauda* of Jenkins & Evermann. As Dr. Gilbert has noticed, this is the adult form of the species called by Dr. Günther *Euctenogobius sagittula*, of which specimens were found by us at Mazatlan.

The species is very similar to *Gobius oceanicus* of the Atlantic.

26. **Gobius soporator** Cuvier & Valenciennes.

Very common.

27. **Scorpæna mystes** Jordan & Starks.

Common.

28. **Labrosomus xanti** Gill.

Common in rock pools.

29. **Labrosomus delalandi** (Cuvier & Valenciennes).

Common in rock pools.

30. **Auchenopterus monophthalmus** Günther.

Not rare; in rock pools.

31. **Paralichthys adspersus** (Steindachner).

Very common: about ten specimens taken.

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XL. Lythrulon opalescens.
XLI. Orthopristis reddingi.
XLII. Eupomacentrus flavilatus.
XLIII. Microspathodon bairdii.
XLIV. Microspathodon azurissimus.
XLV. Halichœres dispilus.
XLVI. Xesurus punctatus.
XLVII. Teuthis crestonis.
XLVIII. Alexurus armiger.
XLIX. Garmannia paradoxa.
L. Aboma etheostoma.
LI. Evermannia zosterura.
LII. Scorpæna mystes.

SOME MEXICAN NEUROPTERA.

BY NATHAN BANKS.

The following sixteen species of Neuroptera were collected by Dr. Gustav Eisen and Mr. Frank H. Vaslit mostly in the Cape Region of Baja California; a few, however, are from Tepic, Territory of Tepic.

Although the collection is too small for generalization, it may be noted that the described species from Baja California were previously known from California; and there is not a single species of general distribution in the United States. The three species of Chrysopa which appear to be new have the wings less veined than usual, the cells being larger than in our eastern species. Of the three species from Tepic one appears to be new, though it would seem strange that such a prominent insect had escaped observation. All of the specimens are alcoholic.

SIALIDÆ.

RAPHIDIA AUSTRALIS nov. sp.

Length 13 mm. Face yellowish; palpi fuscous, annulate with white; antennæ yellowish, darker toward tips; head granulate, above and behind shining greenish, with a smooth, elongate, rufous spot reaching nearly to the ocelli; sides of head behind the eyes straight, not convex; prothorax slender, rufous, contracted before middle, granulate, each granule giving rise to a short hair, an indistinct black fork on the basal portion; legs pale yellow; abdomen black, with many longitudinal rows of yellow spots, those on sides are larger and more or less connected, a black median line on the yellow venter, ovipositor nearly as long as the abdomen, upcurved. Wings quite short, but six or seven costal transverse veinlets, subcosta runs into the costa at a point before the pterostigma twice the length of the latter; pterostigma short, barely twice as long as broad, four short cells beneath it in fore wings, in hind wings two short cells and then a longer one.

Described from two specimens from San Lazaro, Baja California.

MANTISPIDÆ.

SYMPHASIS SIGNATA Hagen.

Hagen, Stett. Entom. Zeit. 1877, p. 208.

Two specimens, one from San Lazaro, the other, San José del Cabo, Baja California. September.

CHRYSOPIDÆ.

CHRYSOPA EXTERNA Hagen.

Hagen, Syn. Neuropt. N. Am. 1861, p. 221.

A single specimen from Tepic. October.

CHRYSOPA PERFECTA nov. sp.

Length 15 mm. Pale yellowish, a black stripe from each eye to the mouth; palpi black; antennæ shorter than the wings, pubescent, whitish, slightly darker toward the tips; prothorax nearly as long as broad, narrowed in front, a large, elongate, rufous spot each side starting cells large, four gradate veins in the first series, five or six in the second series; pterostigma not distinct.

Several specimens, San Lazaro and El Taste, Baja California.

CHRYSOPA VALIDA nov. sp.

Length 14 mm. Pale yellowish, no spots on head; tips of palpi fuscous; antennæ much shorter than wings, whitish, a red line above on basal joint; prothorax much shorter than broad, narrowed in front, barely rufous each side; rest of thorax and abdomen yellowish; legs short, whitish, with white hairs. Wings moderately slender, anterior pair barely pointed, the posterior pair very distinctly so; nearly all the transversals and gradate veins in anterior pair are black or fuscous, and some gradate veins in hind wing; usually but two black transversals before the veinlet which connects subcosta and radius; second cubital cell more than twice as long as broad, barely swollen on the anterior side; division of third cubital cell ends just beyond the first transversal to radial sector; cells quite large, three gradate veins of the first series, and six in second series; pterostigma very distinct, opaque whitish.

A few specimens, El Taste and San José del Cabo, Baja California. September.

CHRYSOPA INCERTA nov. sp.

Length 14 mm. Brownish yellow, face yellow, without spots; antennæ shorter than wings, black, except the basal joint which is yellow and inflated; tips of palpi fuscous; prothorax much broader than long, much narrowed in front, a fuscous stripe on each side, meso- and metathorax with a few fuscous spots; abdomen with many fuscous dots and streaks; legs pale with black hair, tarsi darker, an elongate fuscous spot above near tip of femur.

Wings moderate, anterior pair scarcely pointed at tip, posterior pair a little more so; in anterior pair the transversals, gradate veinlets, many of the marginal veinlets, and most of radial sector, black or fuscous; in posterior pair the transversals and gradate veinlets fuscous; connecting veinlet between subcosta and radius is beyond the second costal transversal; second cubital cell more than twice as long as broad, barely swollen on anterior side; division of third cubital cell ends beyond the first transversal to radial sectors; two or three gradate veins in first series, five or six in second series; pterostigma moderately distinct.

Two specimens, El Taste, Baja California.

MYRMELEONIDÆ.

ACANTHACLISIS FALLAX Rambr.

Rambr., Neuropt., p. 385.
Hagen, Syn. Neuropt. N. Am., p. 223.

Several specimens from San Lazaro and San José del Cabo, Baja California. September. It is distributed throughout tropical America, from California to Argentine.

BRACHYNEMURUS SACKENI Hagen.

Hagen, Can. Entom. 1886, p. 94.

Many specimens from San Jose del Cabo, Baja California. September. Previously known from Arizona, Texas, California and Mexico.

BRACHYNEMURUS CALIFORNICUS nov. sp.

Length ♀ 26 mm., ♂ 35 mm., alar expanse 50–55 mm. Head yellowish, a broad fuscous band through antennal sockets from eye to eye, vertex with two transverse rows of fuscous spots, and behind on each side a brown and a black spot: antennæ with two basal joints pale, a band in front and behind on first one, rest annulate with fuscous; prothorax with a broad fuscous stripe each side, which is forked in front and contains a pale spot behind; on each lower side is a shorter and less definite fuscous stripe: many fuscous spots on each upper side of meso- and metathorax, forming a more or less maculose stripe; other spots on middle, some of them shining black: a broad black stripe below wings, containing an interrupted pale line: legs thickly dotted with fuscous, black on tips of tibiæ, third and fourth tarsal joints wholly, and the tip of the fifth joint: spurs about as long as the basal joint. Abdomen of ♂ longer than the wings, of the ♀ shorter; pale, lineated with fuscous, near the tip often broken into spots more or less connected: second segment mostly fuscous, the others with a median and side stripes, the former narrow in the middle, usually wanting on basal part of basal joints, last segment almost wholly fuscous. Nearly everywhere scantily clothed with white hair and black bristles. The appendages of the ♂ pale, and dotted with fuscous, twice as long as last segment, slender, bowed and slightly upcurved, a comb of stiff bristles above near tip. Wings narrow, hyaline: veins fuscous, pointed with white: small fuscous spots, most distinct on radius and along cubitus; basal part of hind margin of wings with a long fringe; the costal area biareolated from near the base to the pterostigma; the space behind the radius, before the origin of the radial sector, is also biareolated; the furcation of cubitus is considerably beyond the origin of the radial sector.

Numerous specimens from San Lazaro, Sierra El Taste and San José del Cabo, Baja California. September. By its biareolated costal space it is evidently related to *B. inscriptus* Hagen, but the markings are quite different.

BRACHYNEMURUS FRATERNUS NOV. SP.

Length ♀ 18 mm., ♂ 26 mm., alar expanse 35–40 mm. This is so extremely similar in structure and in coloration to the preceding species (*B. californicus*) that it may be but a small variety of it. But the specimens were taken at the same time and place, and show no intermediate sizes, so I shall consider it, for the present at least, as distinct. It differs from *B. californicus*, besides the size, only in that the appendages of the ♂ are scarcely twice the length of the last segment of the abdomen; and the markterior margin, outer branch falling short, sometimes, however, uniting with the inner branch; lower margin each side fuscous; meso- and metathorax above interruptedly lined with fuscous, sides with many fuscous spots usually connected; legs yellowish, with scattered brown dots, tips of tarsal joints blackish: abdomen blackish, a yellowish line above on each side of the basal joints; clothed throughout with black bristly hair. Wings hyaline, veins pale; both pairs evenly spread with many small fuscous spots, of about equal size, usually having for their center the base of a transverse veinlet: pterostigma large, distinct, cream yellow. Wings broad, costal space not biareolate till near middle of wings, space behind radius simple, cubitus forks beyond the origin of radial sector, but before the forking of radial sector. Antennæ of ♂ longer than thorax, a little shorter in the ♀ ; spurs longer than basal tarsal joint: abdomen in the ♂ longer than wings, in the ♀ shorter; appendages of the ♂ shorter than last segment of abdomen, nearly parallel, upcurved, their tips divaricate, a comb of stiff bristles near the tip above.

A number of specimens from Tepic. November.

MYRMELEON RUSTICUS Hagen.

Hagen, Syn. Neuropt. N. Am., p. 233.
Hagen, Can. Entom. 1887, p. 210.

Several specimens from San José del Cabo, Baja California. September.

ASCALAPHIDÆ.

ULULA MEXICANA McLach.

McLachlan, Journ. Linn. Soc., Zool. 1871, p. 248.

A single specimen from Tepic, Mexico. October.

ULULA BICOLOR nov. sp.

Length 30 mm., alar expanse 55 mm. Hair on face white, more grayish on head and thorax; white on coxæ and femora, rest of legs pale yellowish, with black bristles, abdomen marked with brown and yellowish in the usual pattern, pruinose beneath; antennæ much shorter than wings, yellowish, tips of joints fuscous, club pale brownish; pterostigma of fore wings cream white, of hind wings more fuscous; a curved dark cloud below pterostigma of hind wings in some specimens. Venation like *U. hyalina.*

Several specimens from San José del Cabo, September, and Sierra El Taste, Baja California. Differs from *U. hyalina* principally in the shorter antennæ and light colored pterostigma.

THE SPECIES OF THE GENUS XANTUSIA.

BY JOHN VAN DENBURGH,

Curator of the Department of Herpetology.

A large number of specimens of *Xantusia vigilis* and several of *Xantusia henshawi*, which I have recently collected, tempt me to present revised descriptions of the species of this genus of lizards.*

KEY TO THE SPECIES.

a^1. One series of small plates (superciliaries) ever eye.
  b^1. Ventral plates in twelve longitudinal series.
    c^1. A single frontal, eye large. *X. vigilis.*
    c^2. A pair of frontals, eye small. *X. gilberti.*
  b^2. Ventral plates in fourteen longitudinal series. *X. henshawi.*
a^2. Two series of small plates (superciliaries and supraoculars) over eye. Ventral plates in sixteen longitudinal series. *X. riversiana.*

XANTUSIA VIGILIS Baird.

Xantusia vigilis.
1859, Baird, Proc. Ac. Nat. Sci. Phila., 1858, p. 255.
1893, Stejneger, N. A. Fauna, No. 7, p. 198, pl. iii, figs. 1a-1c.

Description.—The body is subcylindrical, with very short limbs. The upper surface of the head is flattened, curving towards the snout. There are three folds on the throat, the anterior connecting the ears and encircling the head. The nostril is pierced at the junction of the rostral, internasal, postnasal and first labial plates. The rostral is in contact with the first labial and internasal plates. The two internasals are followed by a large subhexagonal frontonasal. Behind this are two prefontals (in contact), bordered posteriorly by the single broad frontal and the first superciliary plates. Each of the two frontoparietal plates forms sutures with the frontal, second, third and fourth superciliaries, first supratemporal, parietal, interparietal and its fellow of the opposite side. The parietals and the very large interparietal are bordered behind by the two large occipitals. A row of small supratemporal scutes lies along the outer edge of the occipital and parietal plates. The two large loreals are in contact below with the superior labials, and above with the frontonasal and prefontal plates. In front of the first loreal is a large postnasal. A series of small plates, the upper of which are the superciliaries, usually surrounds the eye. Between this ring and the larger loreal are two or three small plates. There are four or five superior and three or four inferior labials to a point below the pupil. The eye is large, without lids, and with vertical pupil. Its diameter is contained about twice in the distance from the end of the snout to the orbit. The oblique ear opening has a very weak anterior denticulation. The inferior labials

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* Since this paper was written, two new genera of Xantusidæ—Zablepsis and Amœbopsis—have been proposed (Am. Nat., xxix, Aug. 1895, p. 757), to contain *Xantusia henshawi* Stejn. and *Xantusia gilberti* Van D. Neither appears to me well founded. None of the characters alleged to be distinctive of Zablepsis is constant, even as a specific character of *X. henshawi;* and the general scutellation and coloring of *X. gilberti* are so like those of *X. vigilis* as to indicate close relationship. Why these separations should have been made and *X. riversiana* still have been left in the original genus, I cannot comprehend.

The ground color in different specimens varies from smoke gray, through many shades of yellow and brown, to clove brown. Scattered granules are dark brown or black. At times these dark granules are so numerous as to become confluent, with a tendency to form longitudinal lines. In other individuals they are scarcely visible. Some specimens have heavy dotting on a very pale ground; in others the dotting is heavy on a dark ground; many show faint dots on a light ground; and several have few dots on a dark ground. A yellowish line usually runs back on the neck from the outer edge of each occipital plate. Two similar lines are sometimes present on the nape. The lower parts are creamy white, sometimes clouded with brown towards the sides. The young average much darker than the adults.[*]

	mm.	mm.	mm.	mm.	mm.
Snout to vent	47	44	42	37	22
Tail	40[†]	47	61	41	24
Hind limb	17	16	15½	15	9½
Fore limb	12	11	11	10¾	7
Shielded part of head	9¾	9	9	9	6
Snout to ear	9	8½	8	8	5½
Snout to anterior gular fold	9	8½	8	8	5½
Snout to posterior gular fold	15	15	14	13	9
Base of fifth to end of fourth toe	6½	6	5¾	5½	4

History.—The first representatives of *Xautusia vigilis* were found at Fort Tejon, California, by Mr. John Xantus, who furnished the three specimens upon which Professor Baird based his original description, published in the Proceedings of the Academy of Natural Sciences of Philadelphia for 1858. Nothing more concerning it appeared until May, 1893, when Dr. Stejneger recorded two specimens secured by the Death Valley Expedition in 1891. Nothing has been known about its habits, and this very interesting species has been considered one of the rarest of our reptiles.

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[*] See remarks under *Habits*, p. 527.

[†] Regrown.

Distribution.—In reality, *X. vigilis* is the most abundant lizard in the territory it has chosen for its home. It seems to be peculiarly dependent upon the presence of tree yuccas. A glance at Dr. Merriams' map[*] shows that these weird plants grow in each of the localities from which the species has been recorded, viz.: Fort Tejon in the Cañada de las Uvas, and Hesperia, in California, and Pahrump Valley, in Nevada.

Dr. Charles H. Gilbert and the writer collected specimens near Mojave, and found a portion of a cast skin at Victor, California, in November, 1893. In September of the following year, the writer found this species common at Mojave and Hesperia, and secured a single specimen near Cabazon on the eastern slope of San Gorgonio Pass, California. The first three of these localities are situated in the great *Yucca arborescens* belt, which extends along the southwestern edge of the Mojave desert. The last is in a small and apparently isolated grove of smaller tree yuccas, seemingly of another species.

Habits.—Mojave, California, Nov. 4, 1893. About a of a large series of these lizards was merely a matter of physical exertion. Every fourth or fifth stem that was examined gave up its Xantusia, and in one instance five, as many as were previously known to collections, were found under a single tree.

Most of the lizards were found between the bark and the ground, but many had hidden in the thick clusters of dead leaves, from which it was very difficult to dislodge them. When first exposed to the light, they were dark colored, and seemed dazzled for a moment, during which they made no attempt to escape. They were not at all sluggish, however, and, if not caught immediately, made for the nearest cover as fast as their very short legs would permit. This cover was often the collector, and the little lizards either hid under his shoes, or climbed his legs, sometimes even reaching his shoulders. They showed no desire to enter the numerous holes in the ground about them, or to escape by burrowing. Put into a glass bottle they became very light colored in a few minutes, but began to turn dark again immediately after sundown. Young specimens were numerous, and remained dark longer than adults. Many fragments of cast skins were found, but never a whole skin in one place. The stomachs of several individuals contained the wings of some small dipterous insect, the elytra of a little brown beetle, and some very small white bodies which resembled spiders' eggs.

Several specimens were taken alive to The Leland Stanford Junior University, and kept for some months in a large glass jar in which some fine sand and pieces of wood and bark had been placed. At first, they ventured out from their retreat only at dusk unless disturbed, but after a few days they seemed to become more restless, and, urged perhaps by hunger, showed themselves many times each day. At night, when they were always more active, they often climbed to the top of a piece of yucca stem placed upright in the middle of their cage. No desire to burrow was observed. All declined to show any interest in the small beetles and flies, both dead and living, which were placed in the jar, and finally became greatly emaciated. They were chloroformed in March, 1894.

Mojave, Cal., Sept. 17–18, 1894. As it was not practicable to learn by actual investigation whether or not *X. vigilis* hid, during the day, among the thick-growing leaves of the living yuccas, the localities examined in 1893, still clearly marked by the displaced rubbish, were again searched with great care. The fact that very few specimens were now secured in this previously-worked area while the species was very common just outside its limits, is evidence that the specimens found on the ground under the dead branches were in their true diurnal home, and not mere stragglers from the living yuccas.

The specimens were all caught alive and put into a large glass bottle, but were soon killed by the heat, although care was taken to keep them in the shade as much

17–18, 1894, and the habits observed were the same as recorded there.

Cabazon, Cal., Sept. 28, 1894. A single specimen, secured after several hours searching, was shaken from the dry leaves of a dead but still standing yucca about two feet high.

XANTUSIA GILBERTI Van D.

Xantusia gilberti.
1895, Van Denburgh, Proc. Cal. Acad. Sci., vol. v, p. 121, pl. xi.

Description.—The body is subcylindrical, with very short limbs. The upper surface of the head is flattened, curving towards the snout. There are three folds on the throat, the anterior connecting the ears and encircling the head. The nostril is pierced at the junction of the rostral, internasal, postnasal, and first labial plates. The rostral is in contact with the first labial and internasal plates. The two internasals are followed by a large frontonasal, which separates the prefrontal plates. Behind the latter are two large frontals. Each of the two frontoparietal plates forms sutures with one of the frontals, the second and third superciliaries, first supratemporal, parietal, interparietal, and its fellow of the opposite side. The parietal and the very large interparietal are bordered behind by the two large occipitals. A row of small supratemporal scutes lies along the outer edge of the occipital and parietal plates. The two large loreals are in contact below with the superior labials, and above with the frontonasal and prefrontal plates. In front of the first loreal is a large postnasal. A series of small plates, the upper of which are the superciliaries, surrounds the eye.* Between this ring and the larger loreal are two small plates. There are five superior and four inferior labials to a point below the pupil. The eye is small, without lids, and with vertical pupil. Its diameter is contained about two and one-half times in the distance from the end of the snout to the orbit. The oblique ear opening has a weak anterior denticulation. The inferior labials are in contact with the large sublabials. The back, sides, posterior surfaces of the limbs, and the gular regions, are covered with smooth subhexagonal granules. These are flattened on the gular region, but convex on the back and sides. There is a series of large plates along the edge of the last gular fold. The quadrate ventrals are in twelve longitudinal and thirty-two transverse rows. The tail is conical, and covered with whorls of smooth scales, which are very narrow and transversely convex. There are eight and nine femoral pores.

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*Most of these plates are united on the side of the head shown in the figure, pl. xi.

The color above is dark brownish clay, dotted with black on single granules. A pale yellowish line, two granules wide, runs posteriorly from each occipital plate, but is soon lost on the back to reappear over the thigh. The lower surfaces are pale yellowish white.

Snout to vent (about) 39 mm. Tail (about) 38 mm. Hind limb 14 mm. Fore limb 10 mm. Shielded part of head 8½ mm. Snout to ear 8 mm. Snout to anterior pierced in a small scute at the junction of the rostral, internasal, postnasal, and first labial plates. The rostral is broad and rather low, bounded by the first labial, nasal and internasal plates. The two internasals are followed by a large subquadrate frontonasal, which is sometimes divided longitudinally, behind this are two prefrontals, bordered posteriorly by the broad frontal and the first superciliary plates. Each of the two frontoparietal plates is in contact with the frontal, second third and fourth superciliaries, first supratemporal, parietal, interparietal and its fellow of the opposite side. The parietals and interparietal are bordered behind by the two large occipitals. One or more interoccipitals are sometimes present. There is a row of small supratemporals along the outer edge of the occipital and parietal plates. The two large loreals are in contact below with the superior labials, and above with the frontonasal and prefontal plates. The eye is surrounded by a series of small plates, the upper five of which are the superciliaries. Between this ring and the larger loreal are two small plates. There are five superior and three inferior labials to a point below the pupil. The eye is large, without lids, and with vertical pupil. Its diameter is contained about twice in the distance from the end of the snout to the orbit. The ear opening has a very weak anterior denticulation. The symphysial plate is very long. The inferior labials are in contact with the large sublabials. The first pair of the latter are in contact on the median line. The back, sides, upper and posterior surfaces of the limbs, and the gular regions, are covered with subhexagonal granular scales. There is a series of large quadrate plates along the edge of the last gular fold. The quadrate ventrals are in fourteen longitudinal and thirty-three or thirty-four transverse rows. The preanal plates are arranged in three or four rows, labials to a point below the pupil. The eye is small, without lids, and with vertical pupil. Its diameter is contained about two and one-half times in the distance from the end of the snout to the orbit. The oblique ear opening has a weak anterior denticulation. The inferior labials are in contact with the large sublabials. The back, sides, posterior surfaces of the limbs, and the gular regions, are covered with smooth subhexagonal granules. These are flattened on the gular region, but convex on the back and sides. There is a series of large plates along the edge of the last gular fold. The quadrate ventrals are in twelve longitudinal and thirty-two transverse rows. The tail is conical, and covered with whorls of smooth scales, which are very narrow and transversely convex. There are eight and nine femoral pores.

The color above is dark brownish clay, dotted with black on single granules. A pale yellowish line, two granules wide, runs posteriorly from each occipital plate, but is soon lost on the back to reappear over the thigh. The lower surfaces are pale yellowish white.

Snout to vent (about) 39 mm. Tail (about) 38 mm. Hind limb 14 mm. Fore limb 10 mm. Shielded part of pierced in a small scute at the junction of the rostral, internasal, postnasal, and first labial plates. The rostral is broad and rather low, bounded by the first labial, nasal and internasal plates. The two internasals are followed by a large subquadrate frontonasal, which is sometimes divided longitudinally, behind this are two prefrontals, bordered posteriorly by the broad frontal and the first superciliary plates. Each of the two frontoparietal plates is in contact with the frontal, second third and fourth superciliaries, first supratemporal, parietal, interparietal and its fellow of the opposite side. The parietals and interparietal are bordered behind by the two large occipitals. One or more interoccipitals are sometimes present. There is a row of small supratemporals along the outer edge of the occipital and parietal plates. The two large loreals are in contact below with the superior labials, and above with the frontonasal and prefontal plates. The eye is surrounded by a series of small plates, the upper five of which are the superciliaries. Between this ring and the larger loreal are two small plates. There are five superior and three inferior labials to a point below the pupil. The eye is large, without lids, and with vertical pupil. Its diameter is contained about twice in the distance from the end of the snout to the orbit. The ear opening has a very weak anterior denticulation. The symphysial plate is very long. The inferior labials are in contact with the large sublabials. The first pair of the latter are in contact on the median line. The back, sides, upper and posterior surfaces of the limbs, and the gular regions, are covered with subhexagonal granular scales. There is a series of large quadrate plates along the edge of the last gular fold. The quadrate ventrals are in fourteen longitudinal and thirty-three or thirty-four transverse rows. The preanal plates are arranged in three or four rows, the two median ones of the posterior series being largest. The conical tail is somewhat depressed at its base and is covered with whorls of smooth scales, which are very narrow and transversely convex. Eight or ten femoral pores form a series along each thigh.

The ground color above is broccoli brown. On this are numerous large irregular rounded blotches of very dark seal brown, between which run more or less continuous lines of pale yellow. The upper surfaces of the limbs and head are similarly, but less distinctly, marked. The tail is yellow with irregular blotches and half rings of blackish seal brown. The lower surfaces are uniform yellowish white.

	mm.	mm.	mm.
Snout to vent	65	63	57
Tail	83	69	66
Hind limb	—	27	26
Fore limb	—	16	10
Shielded part of head	13	14	12½
Snout to ear	—	13	12
Snout to anterior gular fold	—	13	12
Snout to posterior fold	—	21	20
Base of fifth to end of fourth toe	—	10	9½

Distribution.—*Xantusia henshawi* has been found only

XANTUSIA RIVERSIANA Cope.

Xantusia riversiana.

1883, Cope, Proc. Ac. Nat. Sci. Phila., p. 29.
1889, Rivers, Am. Nat., xxiii, p. 1100.
1889, Cope, Proc. U. S. Nat. Mus., p. 147.

Description.—The limbs are very short, and the body is somewhat depressed. The upper surface of the head is very flat. The nostril is pierced in a small scute at the junction of the rostral, internasal, postnasal, and first labial plates. The rostral is broad and rather low, bounded by the first labial, nasal, and internasal plates. The two internasals are followed by a large hexagonal frontonasal. Behind this are two prefrontals, bordered posteriorly by the broad frontal and the first superciliary and first supraocular plates. Each of the two frontoparietal plates is in contact with the frontal, second, third and fourth supraoculars, parietal, interparietal, and its fellow of the opposite side. The interparietal is bordered behind by the two large occipitals, which are separated from the parietals by two small scutes. There is a row of large supratemporals along the outer edge of the occipital and parietal plates. The two large loreals are in contact below with the supralabials, and above with the frontonasal and prefrontal plates. The eye is surrounded by a series of small plates, the upper five of which are the superciliaries. Between this ring and the posterior loreal are two or three small plates. A series of four supraoculars separates the superciliaries from the frontal and frontoparietal plates. There are five superior and four or five inferior labials to a point below the pupil. The eye is large, without lids, and with vertical pupil. The ear has a weak anterior denticulation. The inferior labials are in contact with the large sublabials. The first pair of the latter are in contact on the median line. The back, sides, upper and posterior surfaces of the limbs, and the gular regions, are covered with flattened granules. There is a series of large plates along the edge of the last gular fold. The quadrate ventrals are in sixteen longitudinal and thirty-two to thirty-five transverse rows. The large preanal plates are arranged in two or three series, edged by smaller scales and granules. The conical tail is covered with whorls of smooth scales which are very narrow and transversely convex. There is a series of from ten to twelve femoral pores along each thigh.

The ground color is smoke gray or cinnamon, with numerous irregular maculations of dark brown or black. These markings are much smaller and less numerous on the lower surfaces. There is considerable variation in the color pattern. One specimen has two narrow parallel black lines, originating at the posterior edge of each occipital plate, and running the whole length of the back. The space between each pair of these lines is unmarked, but the rest of the upper surface is irregularly spotted. Other specimens offer an almost perfect imitation of coarse granitic rock.

Snout to vent 106 mm. Tail (injured) 73 mm. Hind

A LIST OF LICHENS COLLECTED BY MR. ROBERT REULEAUX IN THE WESTERN PARTS OF NORTH AMERICA.

BY DR. STIZENBERGER, KONSTANZ, GERMANY.

Mr. Reuleaux having kindly favored me with a small collection of lichens gathered during his last year's travels through the United States, and comprising specimens from Yellowstone Park and Monterey, Cal., as well as from Sitka, Alaska—some of them never found in North America before—I made the above-mentioned cryptogams the subject of my special study, the results of which are laid down in the following list, intended to serve as a supplement to the late Professor Tuckerman's Synopsis of North American Lichens:

1. SPHÆROPHORON CORALLOIDES Pers., Tuck. New Engl. 82. Sitka.
2. BÆOMYCES ICMADOPHILUS (Ehrh.) Nyl., Tuck. Syn. ii, 7, 8; on dead wood. Sitka.
3. CLADONIA FIMBRIATA f. TUBÆFORMIS (Hffm.) Nyl., Tuck. Syn. i, 241. Sitka.
4. CLADONIA BELLIDIFLORA (Ach.) Schær., Tuck. Syn. i, 252. Sitka.
5. CLADINA RANGIFERINA (L.) Nyl., Tuck. Syn. i, 242. Sitka.
6. RAMALINA CERUCHIS (Ach.) DN. var. CEPHALOTA Tuck. Syn. i, 21; on dead twigs of shrubs. Monterey.
7. RAMALINA RETICULATA (Noehd.) Krmplh., Tuck. Syn. i, 22. Sitka, Monterey.
8. RAMALINA FARINACEA (L.) Ach., Tuck. Syn. i, 25. Sitka.
9. RAMALINA POLLINARIELLA Nyl.; sterile. Sitka.

10. **Alectoria sarmentosa** Ach., Tuck. Syn. i, 45; sterile. Sitka.

11. **Alectoria prolixa** (Ach.) Nyl., *A. jubata* c. *implexa* Tuck. Syn. i, 44; fertile. Sitka.

12. **Chlorea vulpina** (L.) Nyl., Tuck. Syn. i, 28; sterile on dead wood. Yellowstone Park.

13. **Platysma lacunosum** (Ach.) Nyl., Tuck. Syn. i, 35; sterile. Sitka.

14. **Parmelia sulcata** Tayl., Nyl., Tuck. Syn. i, 59: on trees. Sitka.

15. **Parmelia vittata** (Ach.) Nyl., Tuck. Syn. i, 60; fertile on twigs of trees. Sitka.

16. **Parmelia enteromorpha** Ach., Tuck. Syn. i, 60; evernioid, fertile. Sitka.

17. **Stictina scrobiculata** (Scop.) Nyl., Tuck. Syn. i, 102; fertile. Sitka.

18. **Sticta pulmonaria** (L.) Ach., Tuck. Syn. i, 94; fertile. Sitka.

19. **Nephroma arcticum** (L.) Fr., Tuck. Syn. i, 103: sterile. Sitka.

20. **Physcia lychnea** (Ach.) Nyl., Tuck. Syn. i, 50;

26. LECANORA POLYTROPA (Ehrh.) var. ILLUSORIA Ach., Tuck. Syn. i, 192 p. p. *(Lecanora varia* var. *polytropa);* on rocks. Yellowstone Park.
27. LECANORA SYMMICTA (Ach.) Nyl., Tuck. Syn. i, 192 p. p. Thallus red on application of hypochlorite of lime; on dead wood. Sitka.
28. LECANORA HYPOPTOIDES Nyl. in Flora 1867, 371; on dead wood. Yellowstone Park.
29. LECANORA PALLESCENS (L.) Ach., Tuck. Syn. i, 196; on bark. Sitka.
30. LECANORA COARCTATA (Sm.) Ach., Tuck. Syn. ii, 15; on rocks. Yellowstone Park.
31. CŒNOGONIUM INTERPOSITUM Nyl. Coen. 91, Tuck. Syn. i, 258; on thin twigs. Monterey.
32. LECIDEA MEIOCARPA Nyl. in Flora 1876, 577; on cones of cypress. Monterey.
33. LECIDEA SANGUINEO-ATRA (Ach.) Nyl., Tuck. Syn. ii, 21, f. *corticola;* on thin twigs of coniferous trees. Monterey.
34. LECIDEA MYRIOCARPA (DC.) Nyl., Tuck. Syn. ii, 97; on cones of cypress. Monterey.
35. OPEGRAPHA ATRORIMALIS Nyl. in Flora 1864, 488; on cones of cypress and on thin twigs. Monterey.

It still remains to add here the diagnosis of a new western lichen, kindly sent me by Mr. Henry Willey, New Bedford, Mass.

ALECTORIA PACIFICA Stzb. n. sp.

Thallus fruticulous, prostrate, rigid, terete, smooth, brown and shining, from 1 to 1.5 cm. in length, 1–1.5 mm. in width, very much divaricately branched, the branches flexuous, densely intertangled, 0.25 mm. in diameter, at the ends forked with very short branchlets, scarcely 0.05 mm. in width, apothecia and spermogonia unknown.

The anatomical structure perfectly agreeing with *Alectoria;* no traces of an orthogonal-trajectoric direction of hyphæ (as it is found in *Cetraria aculeata).* Cortical and medullary layer with equal, nearly longitudinally running filamentous elements. No central cavity; medullary layer cottony, very loose, sprinkled with heaps of gonidia (these 0.004–8 mm. in diameter). Thin sections of the thallus bordered with a very thin light-brown line. The cortical layer neither thickened nor interrupted by larger cavities (which are frequent in the older cortical tissue of *Cetraria).* No reactions on application of hydrate of potassa and hypochlorite of lime.

Found in the Island of Guadalupe (Pacific Ocean), on humous earth, by Dr. Palmer.

SOME PARASITIC HYMENOPTERA FROM BAJA CALIFORNIA AND TEPIC, MEXICO.

BY WILLIAM H. ASHMEAD.

Through the kindness of Mr. Wm. J. Fox, of the Philadelphia Academy of Sciences, I have been enabled to examine and report upon another interesting collection of parasitic Hymenoptera, made in Baja California and Mexico, in the fall of 1894, by Messrs. Eisen and Vaslit, members of the California Academy of Sciences.

The collection, although small in numbers, represents thirty-eight distinct species, distributed in seven families, and many of which, especially among the microscopic forms, prove to be new to science, and are briefly characterized below.

Family PROCTOTRYPIDÆ.

MESITIUS Spinola.

1. MESITIUS NIGRIPILOSUS sp. n.

♀.—Length 4.5 mm. Black, shining, with sparse black hairs, more especially apparent on the head and the apical half of the abdomen. Scape, pedicel, mandibles and legs, except coxæ and posterior femora, reddish yellow; palpi white; flagellum dark brown; wings subfuscous, the veins brownish yellow.

The head is scarcely longer than wide across the eyes, alutaceously sculptured, with some sparse, shallow, thimble-like punctures scattered over its surface. Antennæ 13-jointed, filiform, tapering toward tips and extending a little beyond the tegulæ; the scape is obconical, slightly curved, about four times as long as thick at apex, while the flagellar joints are all longer than thick, averaging from 1½ to 2 times as long as wide. The pronotum is long, subtrapezoidal, as long as the mesonotum and scutellum united; mesonotum with two complete furrows: scutellum triangular, with a punctured frenum; metathorax quadrate, with several longitudinal raised lines on its disk. Abdomen conic-ovate, polished, longer than the thorax, with the fourth and following segments sparsely fimbriate with black hairs.

Described from one ♀ specimen from Tepic.

Goniozus Förster.

2. Goniozus mexicanus sp. n.

♀.—Length 2 to 2.1 mm. Allied to *G. cellaris* Say, agreeing with it in colorational detail, and in having a small, closed, triangular discoidal cell, but it is readily separated from it, as well as *G. pallidilarsis* Cam., by its smaller size, much longer head, black mandibles and longer abdomen.

The head in this species is nearly twice as long as wide, not narrowed behind the eyes, the space behind the eyes being fully as long as the eye itself, while in *G. cellaris* the head is only a little longer than wide, rounded behind the eyes, the space being much shorter than the length of the eye.

Described from one ♂ specimen from Tepic.

The long oblong head readily separates this species from all other described species in our fauna, having no triangular closed discoidal cell in the front wings.

Family CYNIPIDÆ.

EUCŒLA Westwood.

4. EUCŒLA MEXICANA sp. n.

♀.—Length 1.6 mm. Polished black; mandibles and legs, including all the coxæ, rufous; antennæ black, the 5 or 6 basal joints beneath, rufo-piceous; wings hyaline, the veins pallid, with a slight yellowish tinge. Antennæ 13-jointed, reaching to the base of the abdomen, the scape longer than the pedicel, the first joint of the flagellum slender, but as long as the scape, the following joints, 2–5, gradually shortening, but increasing in thickness, joints 6–10 oblong-moniliform, equal, the last joint ovate, longer than the preceding, the joints 7 to 11 are all delicately fluted.

The scutellum is rugulose, its cup oval, connected with the hind margin of the mesonotum by a short carina, the disk flat, with four punctures and a small fovea on its posterior margin. Front wings with the marginal cell closed, the first abscissa of radius about two-thirds the length of the second. Metapleura with a small tuft of wool just above the hind coxæ. Abdomen a little longer than the head and thorax united, with a narrow but dense woolly girdle at base.

Described from 1 ♀ specimen from San Lazaro.

HEXAPLASTA Förster.

5. HEXAPLASTA CALIFORNICA sp. n.

♀.—Length 1.1 mm. Polished black; mandibles and legs, including coxæ, reddish-yellow; wings hyaline, strongly ciliated, the veins dark brown; the marginal cell except at basal one-third, open along fore margin.

Antennæ 13-jointed, black; scape not quite twice as long as the pedicel, the latter oval; funicle 5-jointed, slender, the first joint 2½ times as long as the second, joints 2–3, moniliform, scarcely longer than thick, joints 4–5 a little longer; club 6-jointed, the joints, except the last which is ovate, oblong-moniliform. Cup of scutellum elliptic, with a small fovea posteriorly and four punctures on its disk. Front wings with the second abcissa of radius stouter and a little longer than the first. The metapleura have a small tuft of wool just over the base of coxæ, while the abdomen is not longer than the head and thorax united, with the usual woolly girdle at base.

Described from one ♀ specimen from San Lazaro.

Family TENTHREDINIDÆ.

HYLOTOMA Latreille.

6. HYLOTOMA PŒCILOIDES sp. n.

♂.—Length 8 mm. Testaceous; head, antennæ, three spots on anterior margin of pronotum, the lateral lobes lateral lobes of the mesonotum and by the different color of the legs.

Family BRACONIDÆ.

IPHIAULAX Förster.

7. IPHIAULAX MEGAPTERA Cam.

Biol. Centr.-Am. Hym., p. 358, Tab. xv, f. 5. ♀

Four ♀ specimens from San José del Cabo.

BRACON Fabr.

8. BRACON EXCELSUS Cam.

Biol. Centr.-Am. Hym., p. 321. ♀

The male of this species has never been described, but to it I refer a single ♂ from San José del Cabo, which differs in no ways from the ♀, except in its smaller size and in the usual sexual differences.

9. BRACON FOXII sp. n.

♀.—Length 6.5 mm.; ovipositor about twice as long as the abdomen. Reddish-yellow; the stemmaticum, antennæ, palpi and legs, except the hind coxæ and basal two-thirds of hind femora, black. Wings smoky black, subhyaline at base, the tegulæ, stigma and veins black.

The surface is smooth, highly polished, impunctate; head subquadrate, the face feebly punctate and clothed with glittering white pile; the under surface of the thorax and the legs are also clothed with pile, but more sparsely so. Abdomen smooth, but the second segment has a triangular elevation at the basal middle, with broad depression on each side of it, while the third has two oblique lateral furrows, and is separated from the second by a deep slightly arcuate but smooth furrow.

Described from one ♀ specimen from San José del Cabo. This lovely species is dedicated to Wm. J. Fox, as a slight appreciation of the many favors he has shown me.

Hedysomus Förster.

10. Hedysomus quadriceps sp. n.

♀.—Length 9 mm.; ovipositor a little longer than the abdomen. Black, with the middle lobe of the mesonotum, the metathorax and the abdomen red.

Head quadrate, polished, the face below antennæ rugulose, the clypeus fimbriate; mandibles broad without teeth within.

Antennæ longer than the body, the scape large, stout, thicker and longer than the pedicel and first joint of flagellum; the first joint of the flagellum is twice as long as the pedicel. The thorax, except the metanotum is smooth and polished, the metanotum being reticulate with large, coarse punctures. The anterior wings have the median and submedian cells of an equal length, with the second abcissa of the radius twice as long as the first; hind wings with the radial cell divided by a cross-vein. Hind femora short, much swollen.

Abdomen much wider than the thorax, the first and second segments irregularly longitudinally striated, the second being divided into three parts by a semicircular palpi and legs whitish. Antennæ 20-jointed, a little longer than the body, the joints of the flagellum more than three times as long as thick. Wings hyaline, the second abscissa of the radius not or scarcely longer than the first.

Described from two ♀ specimens from San José del Cabo.

CHELONUS Jurine.

12. CHELONUS ALBOBASILARIS Ashm.

Proc. Cal. Acad. Sci. (2) iv, p. 123.

One ♂ and one ♀ from San Lazaro. The ♂ agrees with the female except that the abdomen has a transverse fissure at the apex, as in *C. fissus* Prov., *C. minimus* Cr., etc. Some authors have described these as females, but I have ascertained by a careful examination that they are really males.

APANTELES Förster.

13. APANTELES MEXICANUS sp. n.

♂ ♀.—Length 2–2.2 mm. Black, shining, the mesothorax above punctate; the head, disk of mesopleura and episterna of metathorax smooth, impunctate; the scutellum is almost smooth but with some sparse punctures; palpi white; scape, pedicel beneath and legs (except hind coxæ, tips of hind femora and tibiæ and their tarsi which are black or fuscous) reddish-yellow; the abdomen beneath and sometimes the suture between segments 3 and 4, brownish-yellow; flagellum brown-black, paler beneath. Wings hyaline, the stigma and veins brown, the inner vein of the open areolet is a little longer than the recurrent nervure. Metathorax short, rugulose with a median carina. Abdomen with the plate of first segment trapezoidal, about 1½ times as long as wide, the hind angles slightly rounded: the second segment in ♀ is a little shorter than the third, in the ♂ a little longer than the third; segments 1 and 2 are feebly sculptured, the following all smooth and polished; the ovipositor not prominent.

This species spin their cocoons in large masses covered with a white woolly secretion, resembling a cotton-ball, and it is probably parasitic on the larva of some large sphinx moth.

In appearance it resembles *A. congregatus* Say, but is readily separated by its metathoracic and abdominal characters.

Described from many specimens from Tepic and San José del Cabo.

TOXONEURON Say.

14. TOXONEURON SEMINIGRUM Cr.

Tenthredoides seminigrum Cr. Proc. Ent. Soc. Phil. iv, p. 291.
Toxoneuron seminigrum Cr. Can. Ent. v, p. 69.
Toxoneura seminigra Cr. Syn. Hym. p. 239; Ashm. Proc. Ent. Soc. Wash. iii, p. 52.

One ♀ specimen from San José del Cabo.

I have restored the original spelling of this genus, since there is a Dipterous genus Toxoneura.

OPIUS Wesmael.

15. OPIUS BRUNNEIVENTRIS Cr.

of the large fovea at base of the scutellum. Metathorax rugulose, with two smooth areas at base. Wings hyaline, the stigma and veins light brown, the second submarginal cell twice as long as the first transverse cubital vein, the second transverse cubital vein only about two-thirds as long as the first. Abdomen scarcely longer than the thorax, with the first segment longitudinally striated.

Described from one ♀ specimen from San Lazaro.

Family ICHNEUMONIDÆ.

Subfamily II, OPHIONINÆ.

ENICOSPILUS Curtis.

17. ENICOSPILUS MEXICANUS Cr.

Ophion mexicanus Cr. Proc. Phil. Acad. Sci., 1873, p. 374.
Enicospilus mexicanus Cam. Biol. Centr.-Am. Hym., p. 290.

One ♂ specimen from San José del Cabo.

18. ENICOSPILUS MACULIPENNIS Cam.

Biol. Centr.-Am. Hym., p. 292.

One ♂ specimen from San José del Cabo.

OPHION Fabr.

19. OPHION SUBFULIGINOSUS Ashm.

Proc. Cal. Acad. Sci. (2), iv, p. 126.

Two specimens, one ♂, one ♀, from San José del Cabo.

EXETASTES Grav.

20. EXETASTES FASCIPENNIS Cr.

Proc. Ent. Soc. Phil., iv, p. 278.

One ♀ specimen from San José del Cabo.

Subfamily IV, ICHNEUMONINÆ.

TROGUS Grav.

21. TROGUS PULCHERRIMUS sp. n.

♂.—Length 18 mm. Yellow-fulvous: the upper half of the head, the antennæ, upper part of pronotum, metanotum, a spot beneath, the tegulæ, hind legs, apical one-fourth of anterior wings and a band across before the stigma, apical two-thirds of hind wings and the three terminal segments of abdomen black. The head is smooth, polished; the mesonotum punctate, becoming very finely and closely punctate toward the lateral margins, the pronotum punctate only along the upper hind margin; the scutellum conically elevated, sparsely punctate; metanotum with a deep transverse furrow at base, the posterior face with shallow punctures, clothed with a sparse black pubescense; abdomen, except the basal half of the petiole, longitudinally shagreened.

Described from one ♂ specimen from San José del Cabo. A most lovely species, imitating some of the forms found in the genus Joppa.

Œdicephalus Cresson.

22. Œdicephalus albomaculatus sp. n.

♀.—Length 9 mm. Black, shining; the antennal joints 10–20, orbits, face, mandibles, palpi, lateral margins of pronotum, two short lines on disk of mesonotum, spot on their tibiæ at tips, are more or less brown or dusky. Wings hyaline, the tegulæ except a white spot at base, the stigma and the veins black; the areolet is pentagonal, but the lateral veins strongly converge toward each other above, so that the portion of the radius which forms its upper side is very short. The head is polished, impunctate, the mesonotum polished, but finely, although not closely, punctured; the metathorax punctured and finely rugulose, distinctly areolated, the median area divided into two by a central longitudinal carina, while the spiracular and middle pleural areas are confluent. The abdomen has the apex of the petiole and the second segment closely punctate, otherwise smooth and polished, with the gastrocœli distinct, but widely separated.

Described from one ♀ specimen from San José del Cabo.

Subfamily V. CRYPTINÆ.

JOPPIDIUM Walsh.

23. JOPPIDIUM ANNULICORNE sp. n.

♂.—Length 13 mm. Dark rufous, closely punctate; the flagellum, except joints 10–19, prosternum, lower part of mesosternum, surroundings of scutellums, a broad band on the metanotum, all coxæ and trochanters, the hind legs, except tarsi, and the petiole of abdomen, black. Antennal joints 10–19, anterior legs, tips of middle tibiæ and all tarsi, yellow. Wings smoky black, except a yellowish streak at base of the stigma and along the stigma of hind wings; the areolet is large, subquadrate.

Described from one ♂ specimen from San José del Cabo.

This species approaches nearest to *Joppidium ardeus* Cr.

POLYCYRTUS Spinola.

24. POLYCYRTUS ALBOANNULARIS sp. n.

♀.—Length 20 mm. Head and thorax, except scutellums, black; joints 7–14 of antennæ, labium, palpi, anterior coxæ beneath, scutellums, spots on three apical segments of abdomen and the apical half of basal joint of hind tarsi, as well as joints 2 and 3, white; abdomen and legs, except hind tibiæ, basal half of first joint of their tarsi, as well as the two last joints, red; hind tibiæ and tarsi, except as already noted, black or dark fuscous; wings subhyaline, dusky at tips, the stigma and veins fusco-black.

The head and thorax are closely punctate, except a smooth shining space at sides of collar, on upper middle of mesopleura, and that portion of metanotum enclosed by the first transverse carina; the metanotum behind this ridge is transversely rugulose, the lower part of the mesopleura, the surface beneath the insertion of hind wings and the metapleura being clothed with an appressed pubescence.

Described from one ♀ specimen from San José del Cabo.

Family CHALCIDIDÆ.

SMICRA Spinola.

27. SMICRA DELIRA Cr.

Trans. Am. Ent. Soc., iv, p. 41.

One ♂ specimen from Tepic. The species was originally described from Texas, but is widely distributed over the Southern and Western States.

HALTICHELLA Spinola.

28. HALTICHELLA XANTICLES Walk.

Hockeria xanticles Walk., Ann. Soc. Ent. Fr. (2), i, p. 147.
Haltichella xanticles Cr., Syn. Hym. N. A., p. 234.
Haltichella americana How., Bull. No. 5 U. S. Dept. of Agric., p. 9.

Two ♂ specimens from Tepic. This species is also widely distributed over the United States and is very variable in size.

EURYTOMA Illiger.

29. EURYTOMA SEMINATRIX Walsh.

Am. Ent., ii, p. 299.

Three ♀ and two ♂ specimens from Tepic. The species infest woolly cynipid galls and I fail to find any difference between those from Tepic and those bred by myself from galls in Florida. Walsh considered the species only a variety of his *E. auriceps*, but from a close study of many specimens I fail to find intermediate grades, and, as the specific characters are constant, I believe it should be elevated to a distinct species.

30. EURYTOMA TEPICENSIS sp. n.

♀.—Length 2.2 mm. Black; scape and legs, except coxæ and the hind femora medially brownish-yellow; tegulæ black; wings hyaline, the veins brownish-yellow.

Head and thorax, flagellum, legs and apex of abdomen clothed with a sparse, glittering white pubescence. The flagellum is not quite three times as long as the scape, the pedicel is half as long as the first joint of funicle very little longer than thick at apex; funicle 5-jointed, without counting the single ring-joint, the first joint being the longest, or fully twice as long as thick, the following very slightly decreasing in length so that the fifth joint is only slightly longer than thick; club 3-jointed, a little shorter than the scape. The pronotum seen from above is almost as long as the mesonotum, the scutellum to its tip being considerably longer than the mesonotum. Metanotum medially sulcate, the sulcus having two delicate parallel carina, the space between them being filled with delicate transverse raised lines. Marginal vein of front wings rather stout, 1½ times as long as the stigmal, the latter a little shorter than the postmarginal.

Abdomen subsessile, not longer than the thorax, blunt at apex, the fifth segment the longest, about 2½ times as long as the fourth, the sixth about half the length of the fifth, the seventh a little longer than sixth, bearded with white hairs and bearing spiracles, the eighth segment retracted.

Described from one ♀ specimen from Tepic.

the joints binodose, with whorls of long, white hairs. The abdomen is polished black, ovate, attached to the thorax by a long, punctate petiole.

Described from one ♂ specimen from Tepic.

PERILAMPUS Latreille.

32. PERILAMPUS TRIANGULARIS Say.

LeConte Ed. Say's Works, i, p. 381.

Six specimens from San Lazaro.

ORASEMA Cameron.

33. ORASEMA VIRIDIS sp. n.

♀.—Length 3 mm. Head, thorax, scape of antennæ, femora and petiole of abdomen, all metallic green; flagellum black; mandibles rufous, the right with two teeth, the left with only one within; tibiæ and tarsi brownish-yellow; abdomen æneous black; wings hyaline, the veins dark brown.

Described from one ♂ specimen from Tepic.

METAPON Walker.

34. METAPON MEXICANUM sp. n.

♀.—Length 2 mm. Head and thorax æneous black, closely punctate; mandibles rufous; scape, pedicel and legs, except the coxæ and anterior and middle femora, ferruginous; anterior and middle femora metallic brown; hind coxæ blue. Abdomen pointed ovate, polished black, as long as the thorax and keeled beneath. Flagellum incrassated toward tip, the joints, after the first, increasing in width and wider than long. Wings hyaline, the veins brown, the marginal vein twice as long as the stigmal. The fourth abdominal segment is not quite half as long as the third, the fifth only a little shorter than the third, while the sixth and seventh are a little longer.

Described from one ♀ specimen from Tepic.

The species comes nearest to *M. deiphon* Walk, but its smaller size, the metallic colored anterior and middle femora and the shape and relative length of the abdominal segments readily distinguish it.

CATOLACCUS Thomson.

35. CATOLACCUS TEPICENSIS sp. n.

♀.—Length 1.8 mm. Æneous black, the dorsum of mesothorax and the scutellum bronzy-green, finely closely punctate and clothed with a fine whitish pubescence. Scape, knees, tibiæ and tarsi, brownish-yellow, the tibiæ medially more or less obfuscated; mandibles rufous, the teeth black; wings hyaline, the veins light brown. Head transverse, wider than the thorax. Ocelli whitish. Antennæ 13-jointed, the pedicel not quite as long as the first joint of funicle, the last two joints of funicle a little wider than long. Marginal vein of front wings 1¾ times as long as the stigmal, the latter a little shorter than the postmarginal. Abdomen conic-ovate, a little longer than the head and thorax united, æneous black, clothed with a sparse white pubescence beneath.

Wings hyaline, the veins pale yellowish. Antennæ 10-jointed, with two ring joints, the funicle 3-jointed, the first two joints subequal, more than twice longer than thick, the third only about twice as long as thick, the club ovate, 3-jointed. Abdomen ovate, polished black, with a short finely rugose petiole, the body of abdomen at apex is clothed with sparse black hairs.

Described from one ♀ specimen.

This genus has only been characterized recently by the writer, the types coming from St. Vincent, West Indies. The present species approaches nearest to *C. petiolata*, but it is larger, not so smooth, with the facial striæ coarser, while the joints of the funicle are proportionately longer. For description of the genus and the other two species see Journal of the Linnean Society, Zoology, vol. xxv, 1894, pp. 178–179.

TETRASTICHUS Haliday.

38. TETRASTICHUS ORBITALIS sp. n.

♀.—Length 1.1 mm. Shining black; face, orbits, scape, pedicel beneath, anterior margin of pronotum, inner margins of the scapulæ, tegulæ, base of abdomen and legs, except the coxæ and the middle and hind femora, brownish-yellow. Flagellum light brown, the three funicle joints gradually shortening, but also thickening, the first the longest, a little more than twice as long as thick, the last only about 1½ times as long as thick, the club large, stout, ovate, 3-jointed, fully twice as thick as the first joint of the funicle. Wings hyaline, ciliated, broadly rounded at tips. Abdomen sessile, ovate, as long as the head and thorax united and much broader than the thorax, with the sheaths of ovipositor somewhat prominent.

Described from one ♀ specimen from San Lazaro.

A REVIEW OF THE HERPETOLOGY OF LOWER CALIFORNIA. PART II—BATRACHIANS.

BY JOHN VAN DENBURGH,

Curator of the Department of Herpetology.

The long peninsula of Lower California, parched and barren except where some stream, escaping from the sheltering shadows of the upland oaks and pines, winds down to the ocean or sinks almost immediately into the panting soil, has few attractions to offer the batrachia. In consequence, few representatives of this class have been found within its limits. Those that do occur either live in the moister mountainous areas or are of wide distribution and comparatively great adaptation for life in a land arid and desolate. The *Bufo* and the *Scaphiopus* range as far east as Texas; the *Batrachoseps* and *Hyla regilla* occupy a considerable area along the Pacific; while the *Plethodon* has been taken, elsewhere, only in southern California.

HYLA REGILLA B. and G.

Hyla regilla.

(1852, Baird and Girard, Proc. Ac. Nat. Sci. Phila., vi, p. 174.)

This *Hyla* has been recorded from Cerros Island, La Paz, and Cape San Lucas, in Lower California.

List of specimens of Hyla regilla.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
403	San Francisquito, Sierra Laguna, L. C.	Mar. 27, 1892	Gustav Eisen.
404 to 408	Sierra Laguna, L. C.	"	"
427 to 431	"	"	"
600	San Rafael Valley, L. C.	Apr. 29, 1893	A. W. Anthony.
601	San Pedro Martir Mt., L. C.	May 19, 1893	"
682 to 697	San Ignacio, L. C.	April, 1889	W. E. Bryant.
698 to 702	Comondu, L. C.	Mar., 1889	"
988	Miraflores, L. C.	Oct., 1893	Gustav Eisen.
989	"	"	"
997	San José del Cabo, L. C.	Sept., 1893	"
2250	San Francisquito, Sierra Laguna, L. C.	Mar. 27, 1892	"
2256	Sierra Laguna, L. C.	Oct., 1893	"
2257	"	"	"

HYLA CURTA Cope.

Hyla curta.

1866, Cope, Proc. Ac. Nat. Sci. Phila., p. 313.
(1875, Cope, Bull. U. S. Nat. Mus., No. 1, pp. 30, 92.)
(1881, Brocchi, Miss. Sci. au Mex., Batraciens, p. 39.)
(1884, S. Garman, Bull. Essex Inst., xvi, 1, p. 45.)
(1887, Cope, Bull. U. S. Nat. Mus., No. 32, p. 15.)
(1889, Cope, Bull. U. S. Nat. Mus., No. 34, pp. 351, 360.)

There seems to be some confusion in the published references to this species. At the end of the original description of *Hyla curta* is the statement, "No. 5293, 19 specimens half ♂), Cape St. Lucas. Jno. Xantus." Later, in the list of specimens of *H. regilla* in "The Batrachia of North America," is written, "No. 5293—19 specimens—Fort Tejon, Cal.—John Xantus," which is also the entry made by Dr. Yarrow in his Check List. Thus, apparently, the types of *H. curta* are referred to *H. regilla*, with a change in the statement of locality. But *H. curta* is still recognized as a distinct species (Bull. U. S. N. M., No. 34, pp. 351, 360). It would be interesting to know definitely which locality is the correct one, and whether two species of *Hyla* really exist in Lower California.

SCAPHIOPUS COUCHII Baird.

Scaphiopus couchii.
  (1854, Baird, Proc. Ac. Nat. Sci. Phila., vii, p. 62.)
  (1889, Cope, Bull. U. S. Nat. Mus., No. 34, p. 301.)
Scaphiopus varius.
  1864, Cope, Proc. Ac. Nat. Sci. Phila., 1863, p. 52.
  (1881, Brocchi, Miss. Sci. au Mex., Batraciens, p. 27.)
Scaphiopus couchii (var. *varius*).
  (1866, Cope, Proc. Ac. Nat. Sci. Phila., p. 313.)
Scaphiopus varius varius.

List of specimens of Scaphiopus couchii.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
533	San José del Cabo, L. C.	Sept. 23, 1890	W. E. Bryant.
759	"	Sept. 27, 1890	"
763	"	"	"
930 to 972	"	Sept., 1893	Gustav Eisen.
1360 to 1363	Miraflores, L. C.	Sept., 1894	Eisen and Vaslit.
2440 to 2444	San José del Cabo, L. C.	"	"
2512	Miraflores, L. C.	"	"

BUFO PUNCTATUS B. & G.

Bufo punctatus.
(1852, Baird & Girard, Proc. Ac. Nat. Sci. Phila., vi, p. 173.)
1866, Cope, Proc. Ac. Nat. Sci. Phila., p. 313.
(1875, Cope, Bull. U. S. Nat. Mus., No. 1, p. 29.)
(1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 162.)
(1887, Cope, Bull. U. S. Nat. Mus., No. 32. p. 10.)
(1887, Belding, West Am. Scientist, iii, 24, p. 99.)
(1889, Cope, Bull. U. S. Nat. Mus., No. 34, p. 262.)
Bufo beldingi.
1882, Yarrow, Proc. U. S. Nat. Mus., p. 441.
(1883, Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 163.)
(1887, Belding, West Am. Scientist, iii, 24, p. 99.)

Judging from the large series of specimens secured by the Academy's collectors, toads of this species must be very numerous in the "Cape Region" of Lower California. Several which were collected in September contain eggs nearly ready for deposit.

Mr. Xantus found this toad at Cape San Lucas, and Mr. Belding at La Paz.

List of specimens of Bufo punctatus.

Cal. Acad. Sci. No.	Locality.	Date.	Collector.
432	Santa Anita, L. C.	Apr. 4, 1892	Gustav Eisen.
634 to 636	San Ignacio, L. C.	April, 1889	W. E. Bryant.
745 to 747	Agua Caliente, L. C.	Oct., 1890	"
895 to 900	San José del Cabo, L. C.	Sept., 1893	Gustav Eisen.
927 to 929	"	"	"
977	Corral de Piedras, Sierra El Taste, L. C.	"	"
978	"	"	"
1364 to 1386	Miraflores, L. C.	Sept., 1894	Eisen and Vaslit.
2129 to 2190	San José del Cabo, L. C.	"	"
2401 to 2439	"	"	"

PLETHODON CROCEATER Cope.

Plethodon croceater.

(1867, Cope, Proc. Ac. Nat. Sci., Phila., p. 210.)
1869, Cope, Proc. Ac. Nat. Sci. Phila., p. 100.
(1875, Cope, Bull. U. S. Nat. Mus., No. 1, pp. 27, 92.)
1880, Lockington, Am. Nat., xiv, p. 295.
(1883, Yarrow, Bull. U. S. Nat. Mus.. No. 24, p. 192.)
(1887, Cope, Bull. U. S. Nat. Mus., No. 32, p. 9.)
1889, Cope, Bull. U. S. Nat. Mus., No. 34, p. 150.

Mr. Xantus is said to have collected a *Plethodon* of this species at Cape San Lucas, and Mr. Lockington has recorded one from the northern part of the peninsula, seventy-five miles southeast of San Diego, California.

THE CALIFORNIA PHRYGANIDIAN (PHRYGANIDIA CALIFORNICA PACK.)

BY VERNON L. KELLOGG AND F. J. JACK.

(With Plate lvi.)

Last fall and this spring the oak trees, especially the live-oaks (*Quercus agrifolia*), in the vicinity of the Leland Stanford Jr. University and of Palo Alto suffered serious defoliation by the attacks of the larva of *Phryganidia californica*. The pest is not remembered to have been so abundant here before. The caterpillars appeared in astounding numbers, the continuous dropping of frâss from the infested trees attracting common attention. The caterpillars were conspicuous, also, on the tree trunks and on fences and the walls of buildings near trees, often massing in a way suggesting the well-known *Datana* masses, although never forming such compact and isolated bunches. The special interest attaching to this insect, because of its systematic isolation among the Heterocera, its limited geographical range, and its capacity, abundantly shown last fall and this spring, for damage, led us to make the observations recorded in the following tober 1 most of the larvæ had pupated, the naked chrysalids being conspicuous objects on the tree-trunks, on fences and the walls of buildings near trees. When the larva is ready to pupate, it lies along the bark head downward with body contracted longitudinally and a little curved. It then spins a thin irregular net of silk (showing well when the larvæ pupated on the glass sides of breeding jars), covering very thinly the surface against which it lies. The chrysalid is attached to the supporting object only by the projecting caudal process (see *d*, plate lvi), although the body of the chrysalid rests against the thin silken net. The fresh chrysalid is fleshy pinkish-yellow, and it retains a considerable sensitiveness and mobility up to the time of the issuance of the imago.

By the middle of October many moths were flying. In the laboratory the pupal stage was uniformly of ten days' duration. The moths were very abundant all through the latter half of October, fluttering with a pretty, wavering flight through the foliage of the oaks. The eggs are laid in patches commonly on the under side of the oak leaves (occasionally on the upper side), from two dozen (rarely fewer) to four dozen being laid together. They lie in a single layer, almost or barely touching one another, and often in irregular lines. In the laboratory the egg stage lasted twelve days in all instances noted. But out of doors the eggs did not begin hatching until about December; and then they hatched irregularly, unhatched eggs being found up to January 1. As late as February 14 larvæ in the first stage were found. The eggs show in a couple of days a shallow polar depression, and surrounding it a zone of pinkish-brown. This zone in eggs five days old is a striking cherry red. Just before hatching the egg becomes pink and ashy mottled all over. The larvæ display a singular slowness of growth.

In the laboratory, from eggs hatched December 15, the larvæ first moulted December 29, or fourteen days after hatching. The second moult occurred January 11, the third January 28—at this time larvæ in the trees out of doors were in the second stage, *i. e.*, had moulted but once—the fourth moult occurred February 22, the fifth, March 15, and pupation March 27. The imagines issued April 6 and 7, or ten or eleven days after pupation, agreeing with the duration of the pupal stages in the fall before. Thus we have the winter passed by the insect in an active larval stage, the evergreen condition of the live-oaks lending itself to such a life history. Out of doors the larval stages were passed more slowly than in the laboratory. At the time of the issuance of the moths in the in-door breeding cages on April 6, larvæ just making the third moult were found in the live-oaks. The out of doors larvæ began pupation by the middle of May, the moths appearing at the end of the month and during the first part of June. The newly hatched larvæ and those in the second stage, in feeding, merely skeletonize the leaves, the soft parenchymatous tissue being eaten, and windows. The effectiveness of this parasite wherever it occurred is shown by the fact that of 100 chrysalids examined on November 1, 67 were parasitized by this ichneumon; and from 144 chrysalids gathered and kept in the laboratory but 11 moths issued, 99 of the chrysalids being parasitized by *Pimpla behrendsii* Cress., 7 chrysalids containing other parasites, and the others being dead from various causes.

Although most abundant on the live-oaks *(Q. agrifolia)* the larvæ attack other oaks. We have found them on *Quercus lobata*, *Q. kelloggii*, *Q. dumosa* and *Q. douglassii*. The live-oaks in this vicinity begin to put out new leaves about January 1, but in the case of many of the trees badly defoliated by the larvæ in the autumn, new leaves appeared much earlier than the first of January. The wintering of the insect in a larval condition is only possible in the evergreen oaks, and they are thus the natural and usual host of the pest. At the time of the hatching of the first of the autumn brood of eggs (latter part of November) the leaves of the deciduous oaks begin to fall. But, oddly, the eggs were found to be deposited on the leaves of both the white oak and Douglas's oak (deciduous oaks), and the larvæ hatched only to die of starvation. By this suicidal means the pest aids in depleting its own numbers. The new leaves of the deciduous oaks appear about April 1, before the eggs for the summer brood of larvæ are deposited. These eggs, therefore, can safely be laid on the leaves of these trees, but the eggs laid by the fall moths on the foliage of these trees give up their young to certain destruction.

As to the number of generations which appear annually of this insect, Henry Edwards (quoted by Packard in Hayden's Report of the U. S. Geological Survey of the Territories for 1875, and in Forest Insects, Fifth Report of the U. S. Entomological Commission, 1890) states that there are two. Packard, in Forest Insects, quotes Mr. Behrens of San Francisco as saying that three generations appear annually. In our year of observation but two generations appeared. Moths were flying in May, 1894, the larvæ from whose eggs became full-grown in September, and produced the October moths. From the slowly and irregularly hatching eggs of these moths came the slow-growing winter brood of larvæ which became full-grown in the laboratory in the last of March, but out of doors not until the middle of May. From these came again a late May and early June brood of moths. It is to be noted that the occasional appearance of moths, as, for example, two specimens captured on February 20, 1895, resulting from the more rapid growth and transformation of a few individuals of a brood, is not an unusual phenomenon in the life history of this insect. It may explain, too, some of the unwarranted statements occasionally heard concerning this pest, crediting it with five or six annual generations.*

The descriptions of the egg, larval stages and chrysalid eter .85 mm. Color, shining yellowish-white. In two days a circular zone about the depressed apex is brownish pink, which in five days after exclusion becomes cherry-red. Just before hatching the whole egg is mottled with dark-pinkish. Laid on the lower (rarely upper) surface of the leaves of *Quercus agrifolia* and of other species of *Quercus*, in patches of from thirty to fifty.

Larva, first stage (see *b*, plate lvi) — Head large, rounded, bilobed, the mesal line distinct, bearing a few prominent hairs: color when excluded from the egg, pearl-gray, soon changing to light brown, shining, width .68 mm. Body cylindrical, with conspicuous setigerous tubercles, arranged as follows: a row on each side of the dorsimeson, composed of two large approximated tubercles on each segment, the caudal tubercle of each segment lying slightly laterad of the cephalic one. These dorsal rows bend a little laterad on the second and third segments. Two rows on each side, the upper row consisting of large tubercles one on each segment, the lower row of smaller ones two on each segment, the caudal tubercle of the lower pair being a little above the cephalic one. Cervical shield, broad and widest at mesal part, brown. Anal shield, distinct, brown. Color of the body ashy at exclusion, changing in four hours to bright yellowish green above and ashy below, tubercles brown to black, and there is a narrow, subdorsal, interrupted reddish line extending whole length of the body; legs concolorous with venter, and marked with brown blotches. Triangular, brownish blotches occur in mesal line on segments 4, 6, 8 and 11, and may or may not extend across the dorsum of segment. Length (at exclusion from egg) 2.05 mm.; width .26 mm.

Second stage — Head shining brown, ocelli and mouth parts dark reddish brown; width 1.14 mm. The brown coloration of the tubercles has disappeared. Two prominent, reddish, continuous, subdorsal lines, also a faint interrupted median dorsal line. On the pleurum, reddish markings on segments 4–11 forming two interrupted rows of short, sinuous lines. Prominent reddish-brown blotches on segments 8 and 11. Length 7 mm.; width .65 mm.

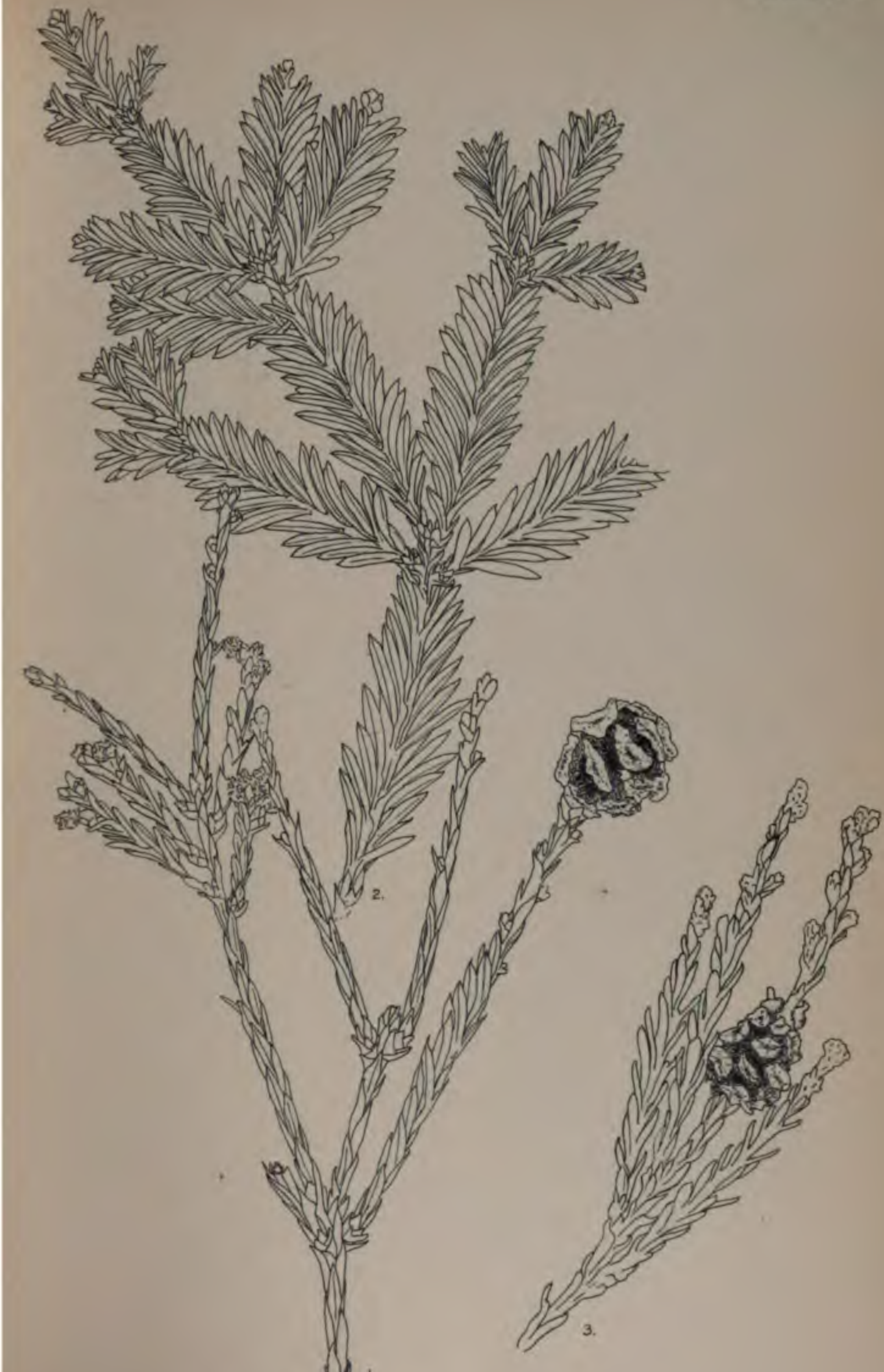
Third stage—Width of head 1.45 mm. Color of body bright yellow. Subdorsal lines more pronounced than in previous stages and continuous; mesal line present or not; on segments 2 and 3 are two parallel reddish lines extending ventrad from the subdorsal line a short distance. Cervical shield black. Length 10 mm.; width .78 mm.

Fourth stage—Width of head 1.88 mm. There may or may not be faint interrupted lines between the median dorsal and subdorsal lines. A more or less interrupted, ill-defined reddish supra-stigmatic line appears, with narrow uneven lines running longitudinally between this supra-stigmatic line and the subdorsal lines. (All these proximal segment of antennæ whitish, distal parts of remaining segments black; width of head 2.57 mm. Body cylindrical, 11th and 12th segments humped, smooth, shining, tubercles and hairs not noticeable; general color light yellow. An alternative body color is black above and on sides, and ashy-gray on venter. The majority of the fall brood were yellow: the majority of the spring brood black. Cervical shield prominent, black; anal shield small, black. Thoracic legs black. The reddish median dorsal line widens or becomes a large blotch on the 8th segment. There is a conspicuous transverse blotch on the humped 11th segment. Smaller blotches occur also sometimes on the 4th and 6th segments. There is a narrow, uneven, black line on each side of the median dorsal line parallel with it and continuous from 1st to 12th segments. Laterad of these narrow lines, there is a conspicuous broad black subdorsal band composed of several contiguous narrow lines, the composing lines frequently blending. On segments 6–11 just above the bases of the prolegs, which are yellowish white with reddish markings, there are two short sinuous reddish lines, the lower one of each pair being the broader and more distinct and the space between them being pearly-white in color. Connecting the upper one of these two lines with the subdorsal band there is on segments 6–9 a short sinuous vertical reddish line. When the general body color of the larva is black the spaces between the narrow dorsal lines remain yellowish appearing as four narrow parallel dorsal lines running the whole length of the body. Length 23–27 mm.: width 3 mm.

At end of this stage, the larvæ let themselves down from the tree to the ground by a silken thread, and then crawl up on the side of an adjacent building or upon a fence, or upon the trunk of the tree, or they crawl down from the foliage to the tree trunk, and form a naked chrysalid.

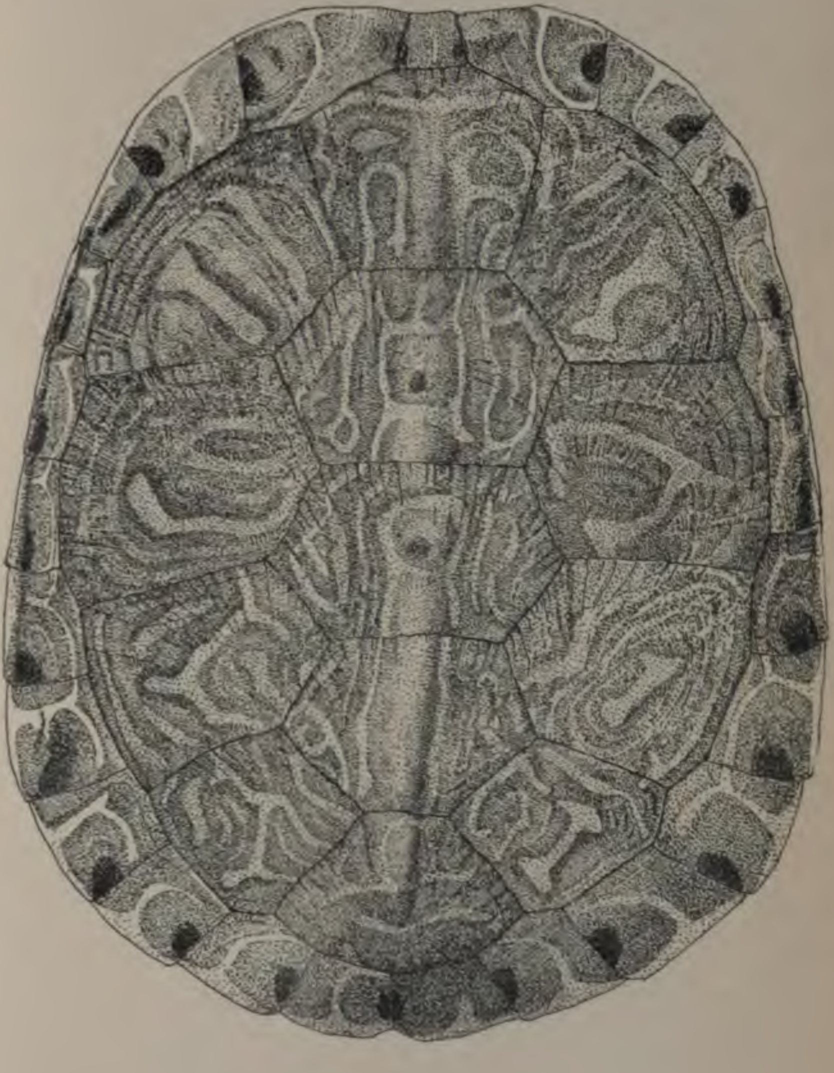
Pupa (see *d*, plate lvi)—Naked, suspended by cremaster, greenish-white with yellow suffusion and black markings. Wing cases pearly bluish-white, with many black lines of different lengths. On the dorsum of body an interrupted median black line frequently expanding blotch-like. On either side of it on abdomen, and separated from it by distinct yellowish markings, an interrupted broad black band extending to base of cremaster. Spiracles black, surrounded by yellow. Ventrad of the line of spiracles a faint narrow longitudinal line of pinkish, and on the venter two submedian bands of black composed of narrow lateral blotches. Cremaster single, strong, length 1.5 mm. Chrysalid concave on dorsum and convex on venter, length 12 mm.; width 4 mm.

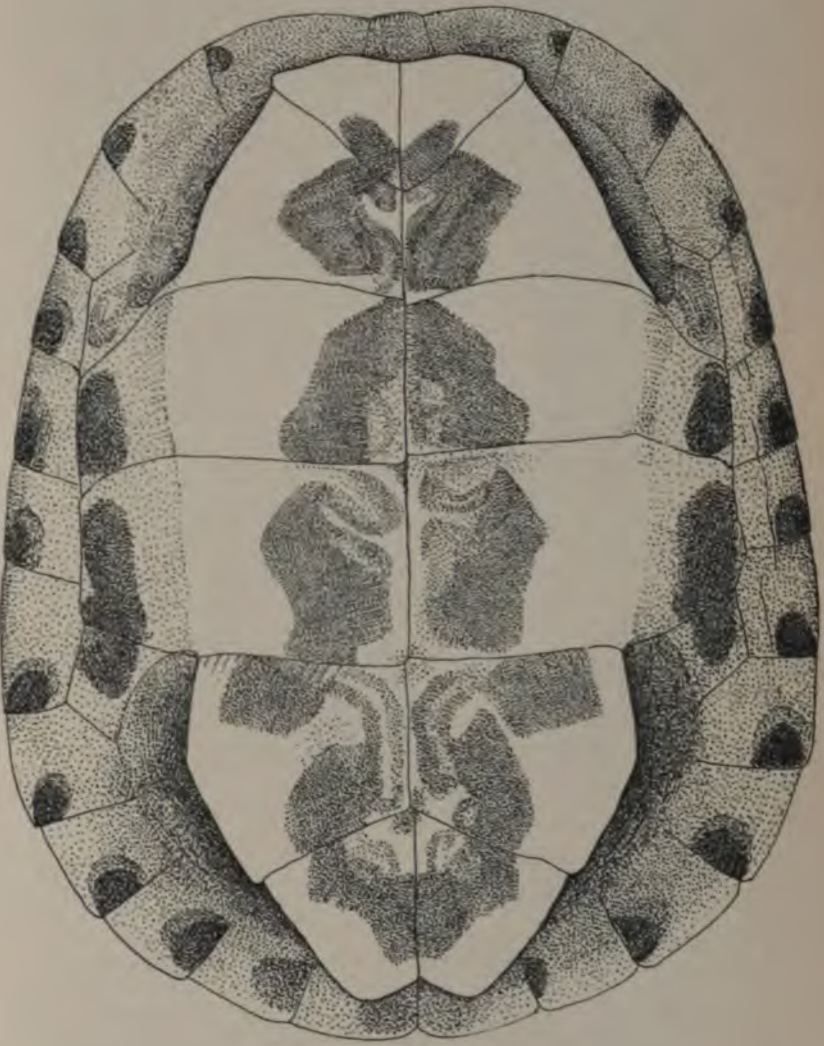
Imagines (see *e*, plate lvi)—Males easily distinguished from females by longer pectinations of antennæ, and indistinct yellowish patch just beyond apex of discal cell of fore wing.



SEQUOIA SEMPERVIRENS ENDL.

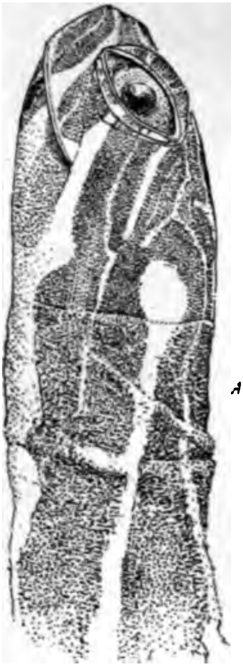
PLATE IV.





[illegible] Del.

PLATE VI.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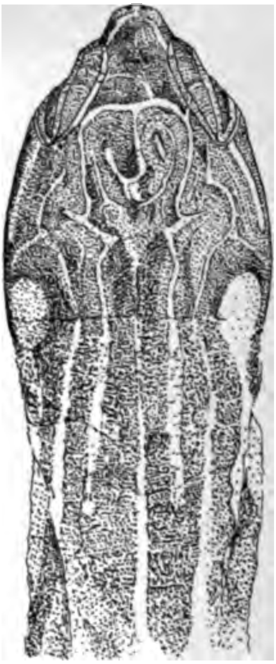
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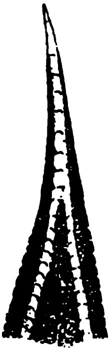
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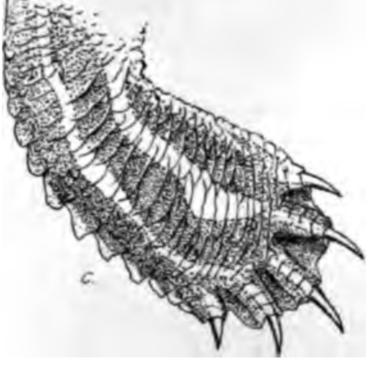
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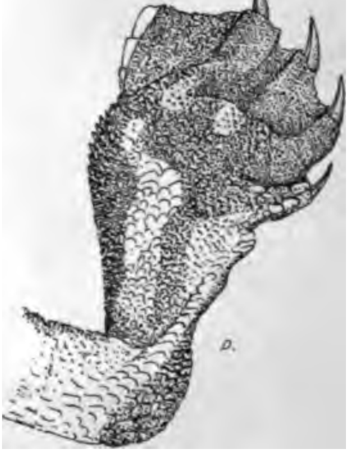
D.

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PLATE [illegible]

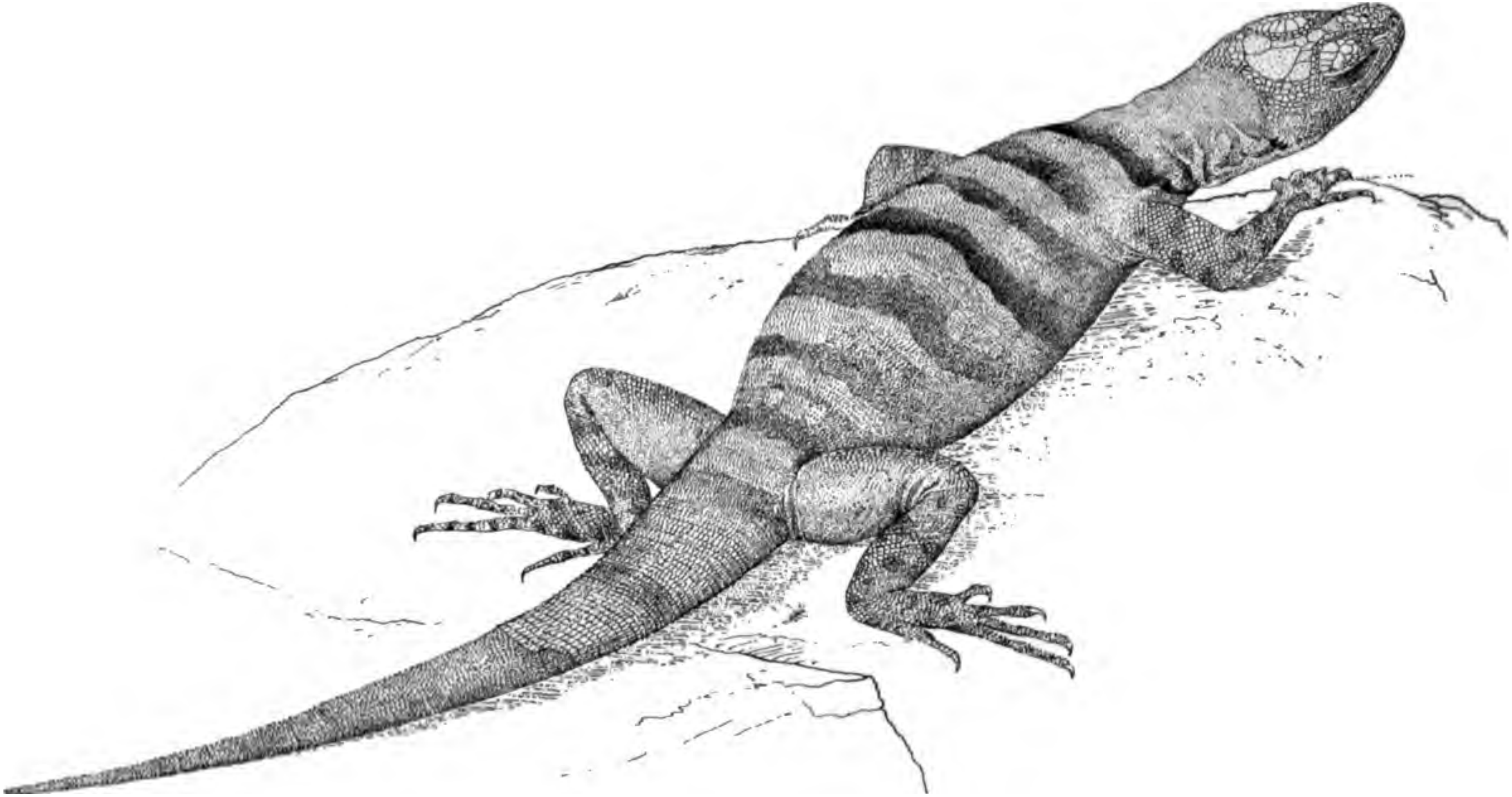
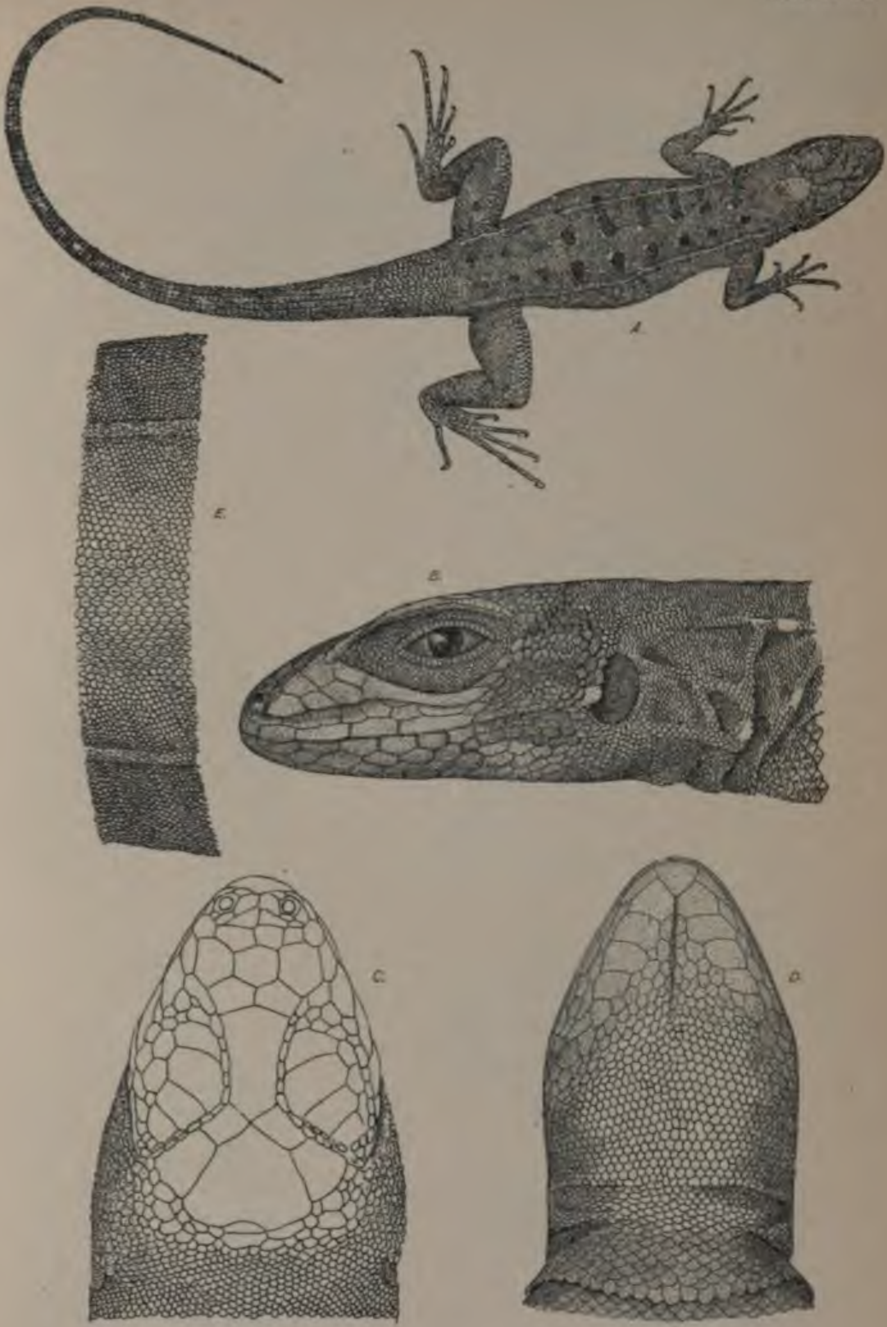


PLATE IX.



A.L. Herrera Del.

PLATE X.

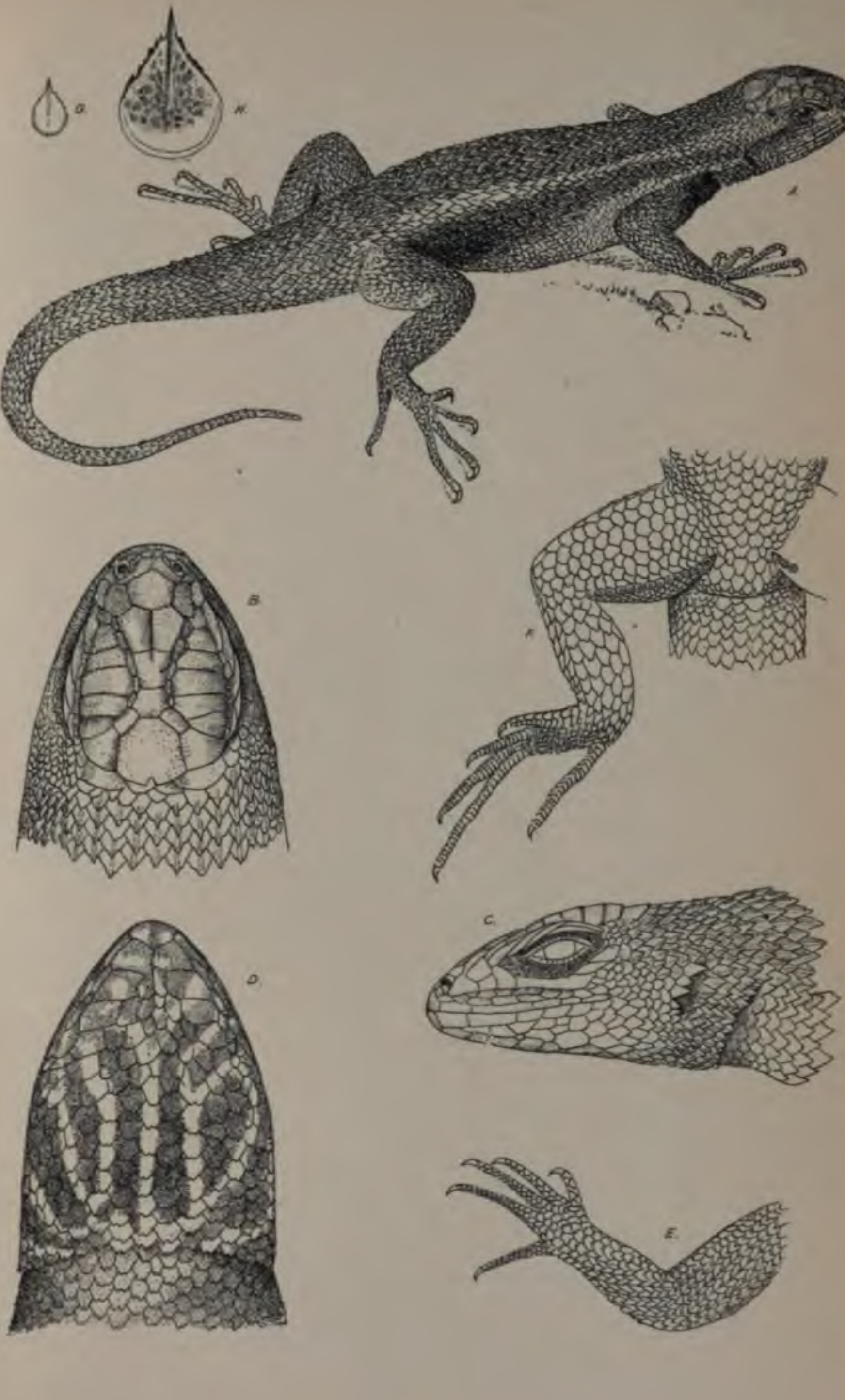


PLATE XI.

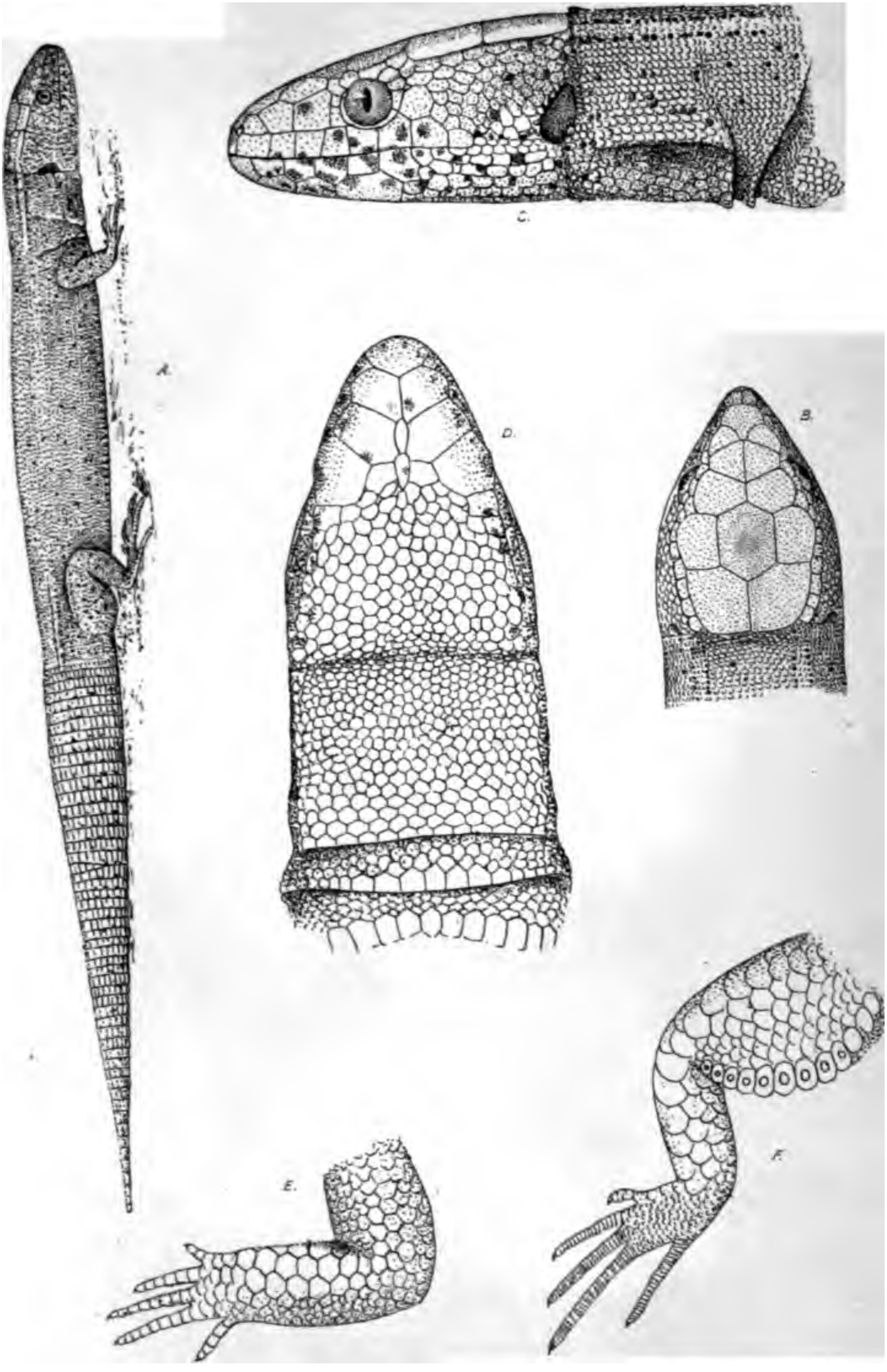
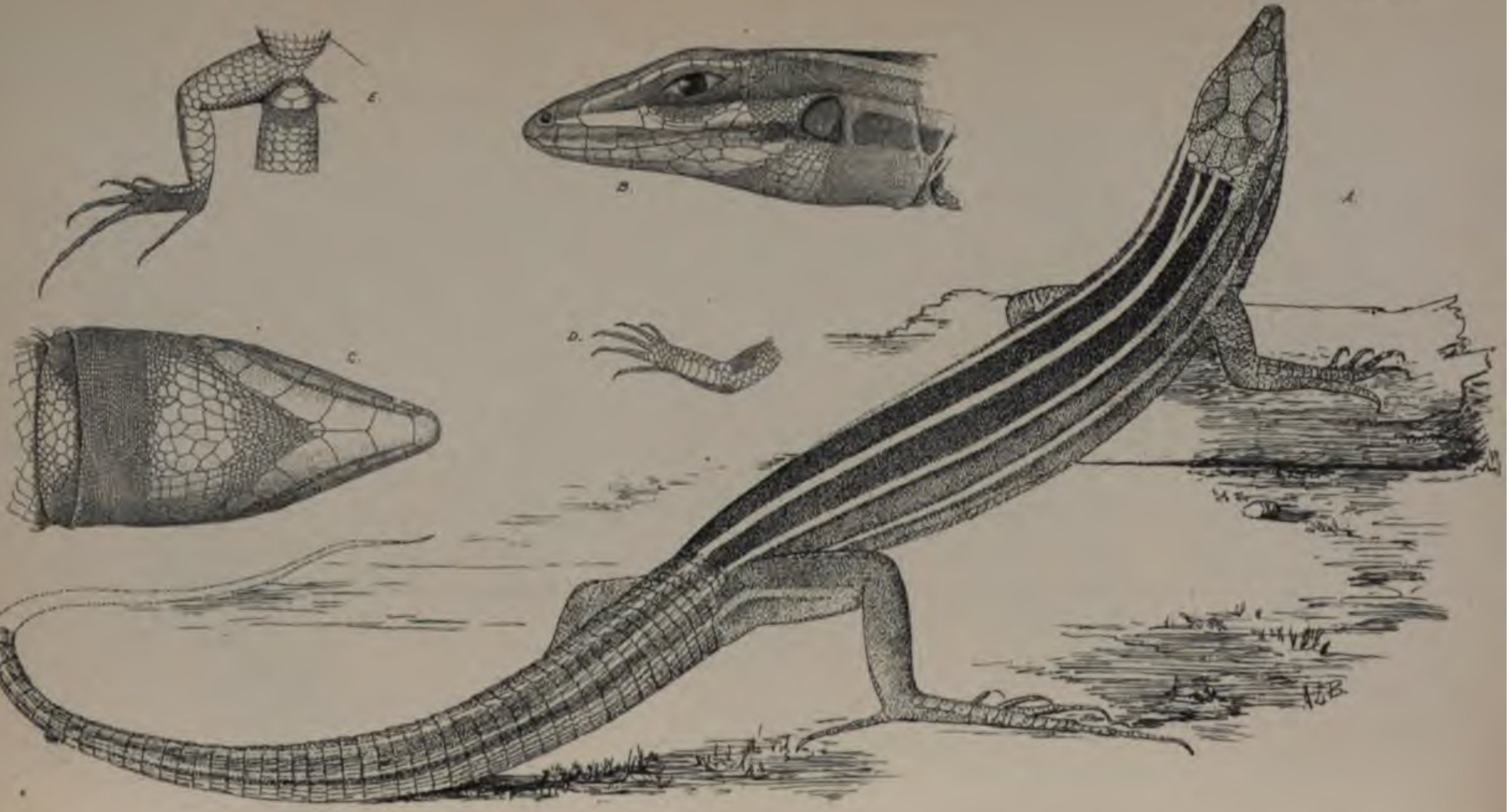


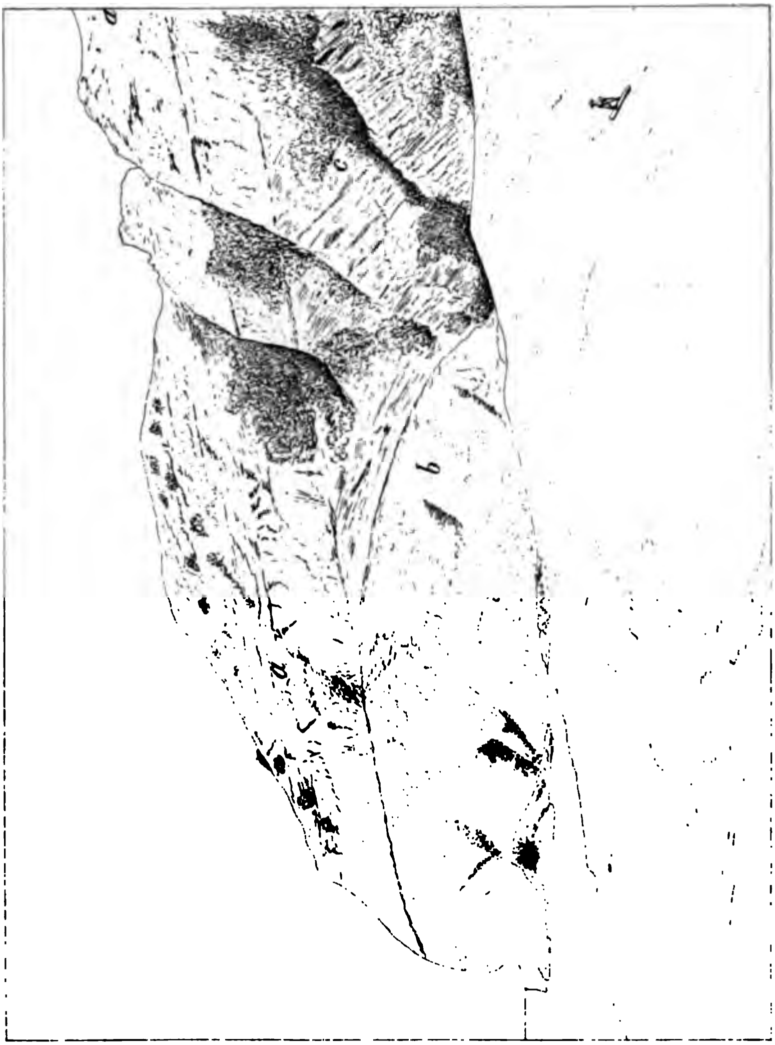
PLATE XII.



A.L. Bremer Del.

LITH. BRITTON & REY, S.F.

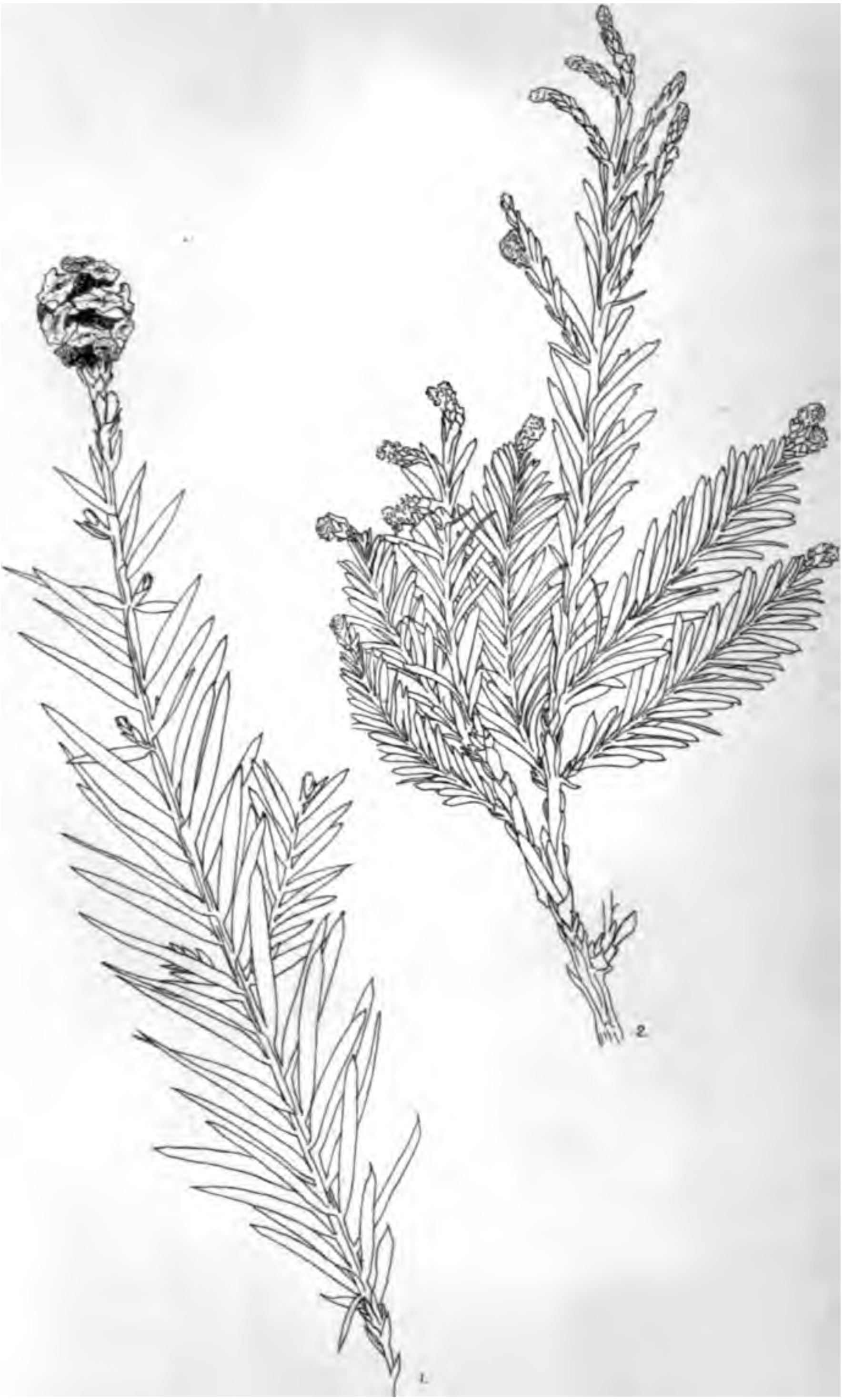
PLATE XXV.



Mussel Rock from the South, showing marine Pleistocene (*a*), overlying sand dunes (*c*), and igneous rocks (*b*).

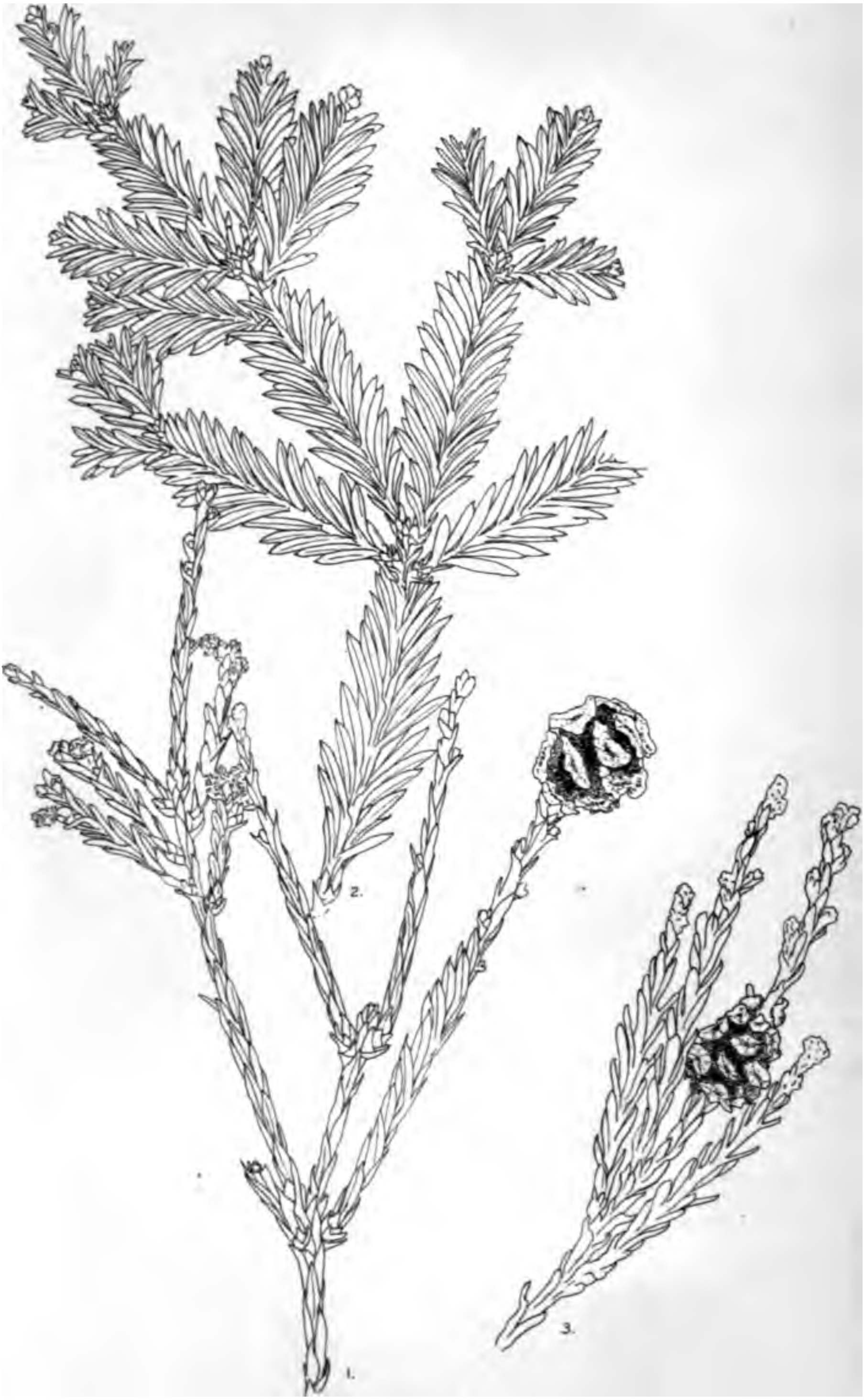
V.

PLATE XV.



SEQUOIA SEMPERVIRENS ENDL.

PLATE XVI.



SEQUOIA SEMPERVIRENS ENDL.

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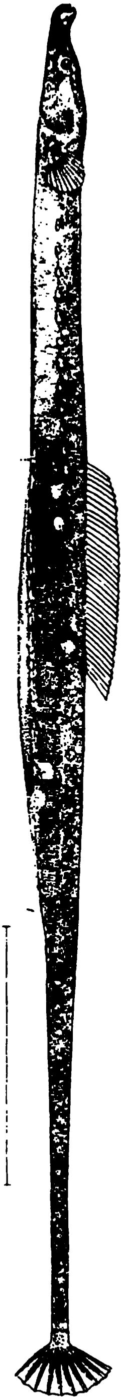
PLATE XXX.

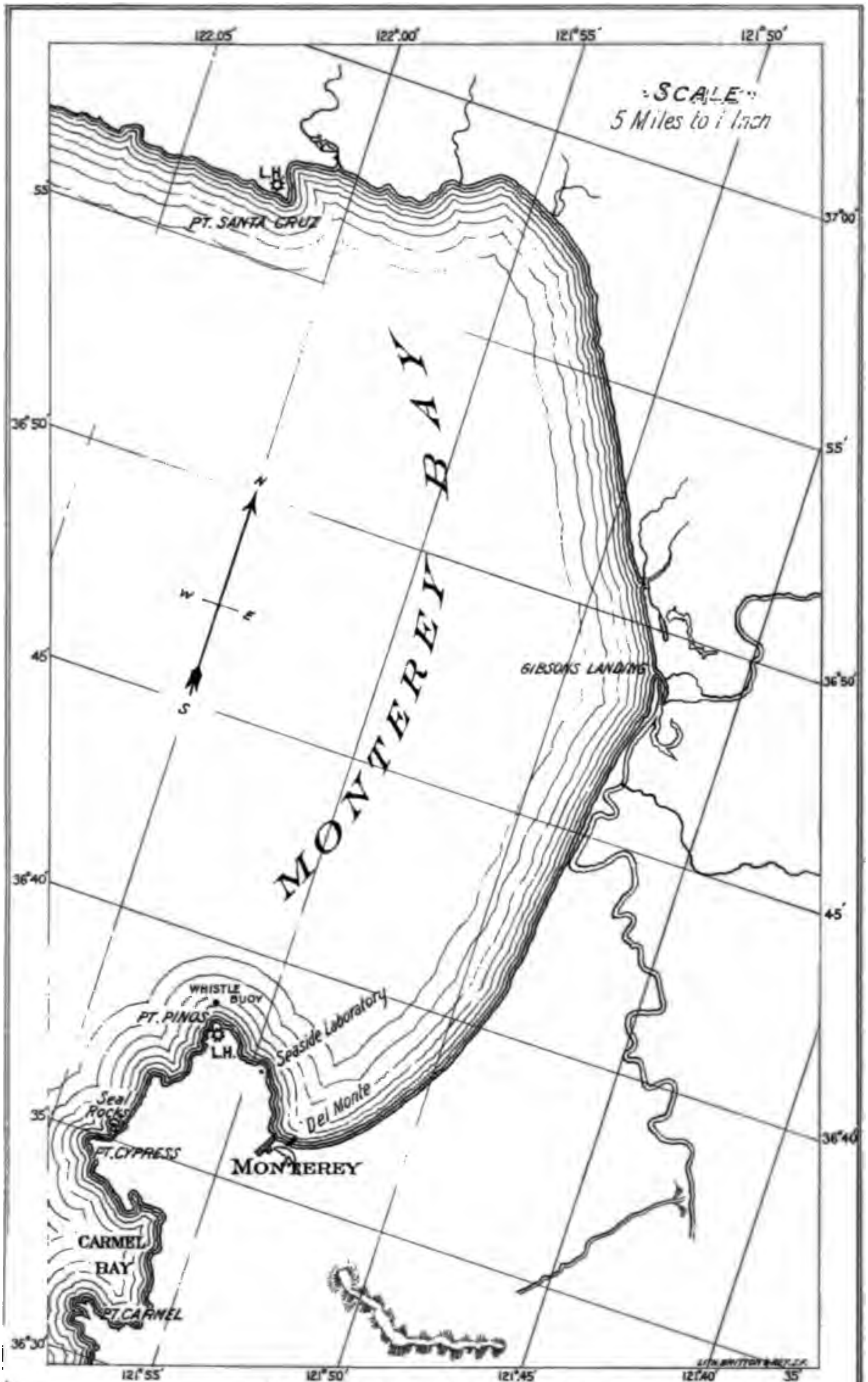


SIPHOSTOMA STARKSII.

L. Brown Del.

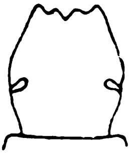
LITH. BRITTON & REY, S.F.

PLATE XIX.



Map of Monterey Bay and Vicinity.

5



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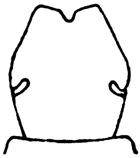

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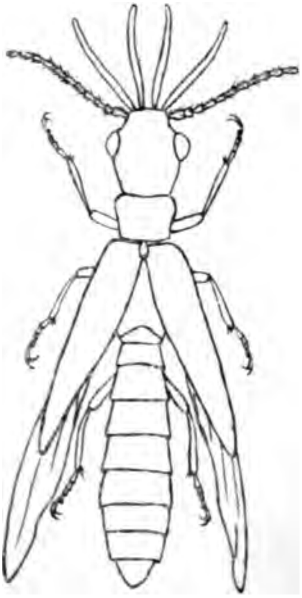

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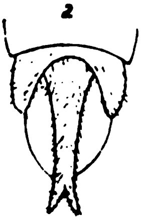

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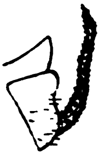

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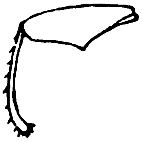

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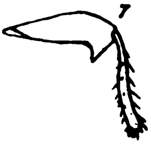

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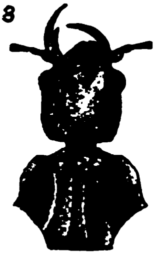

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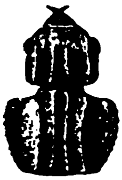

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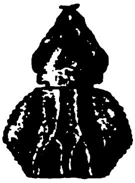
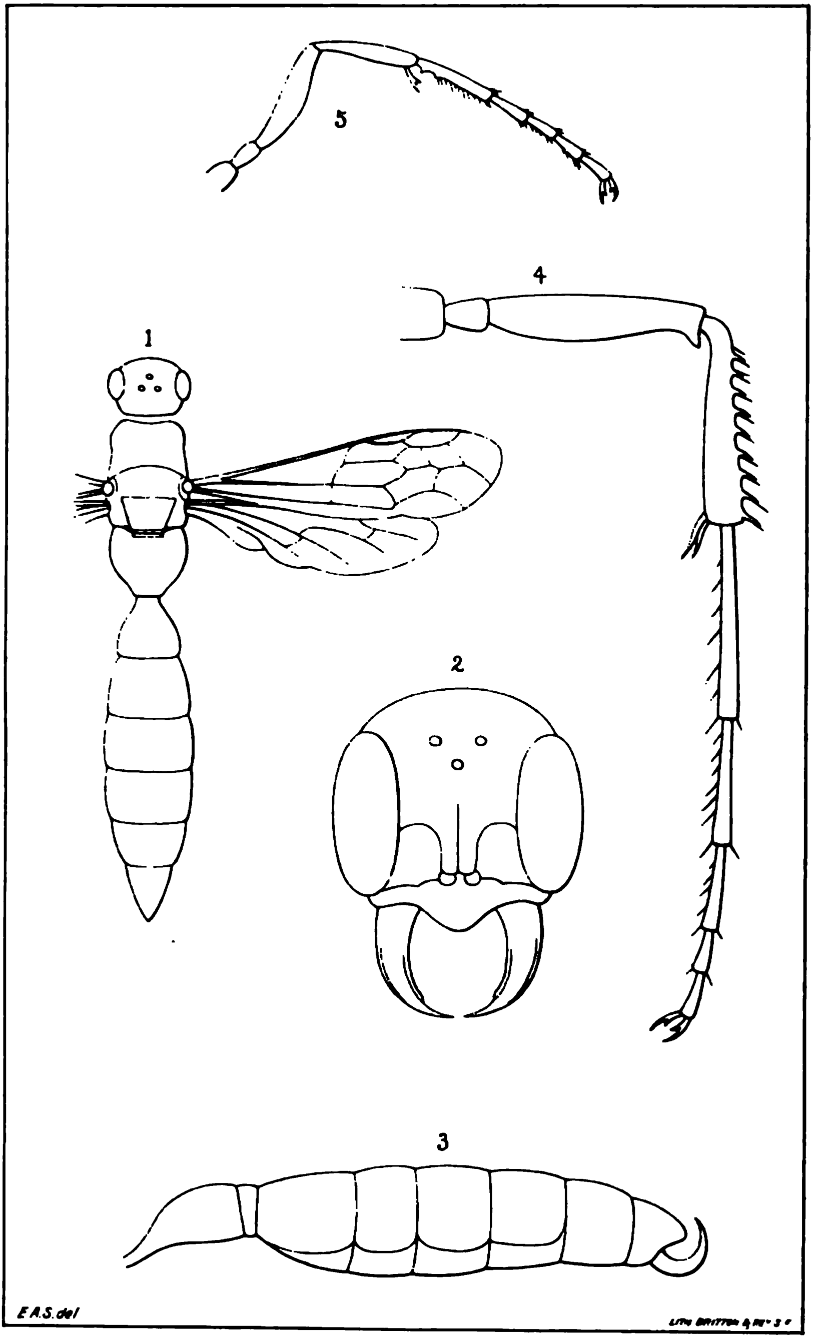


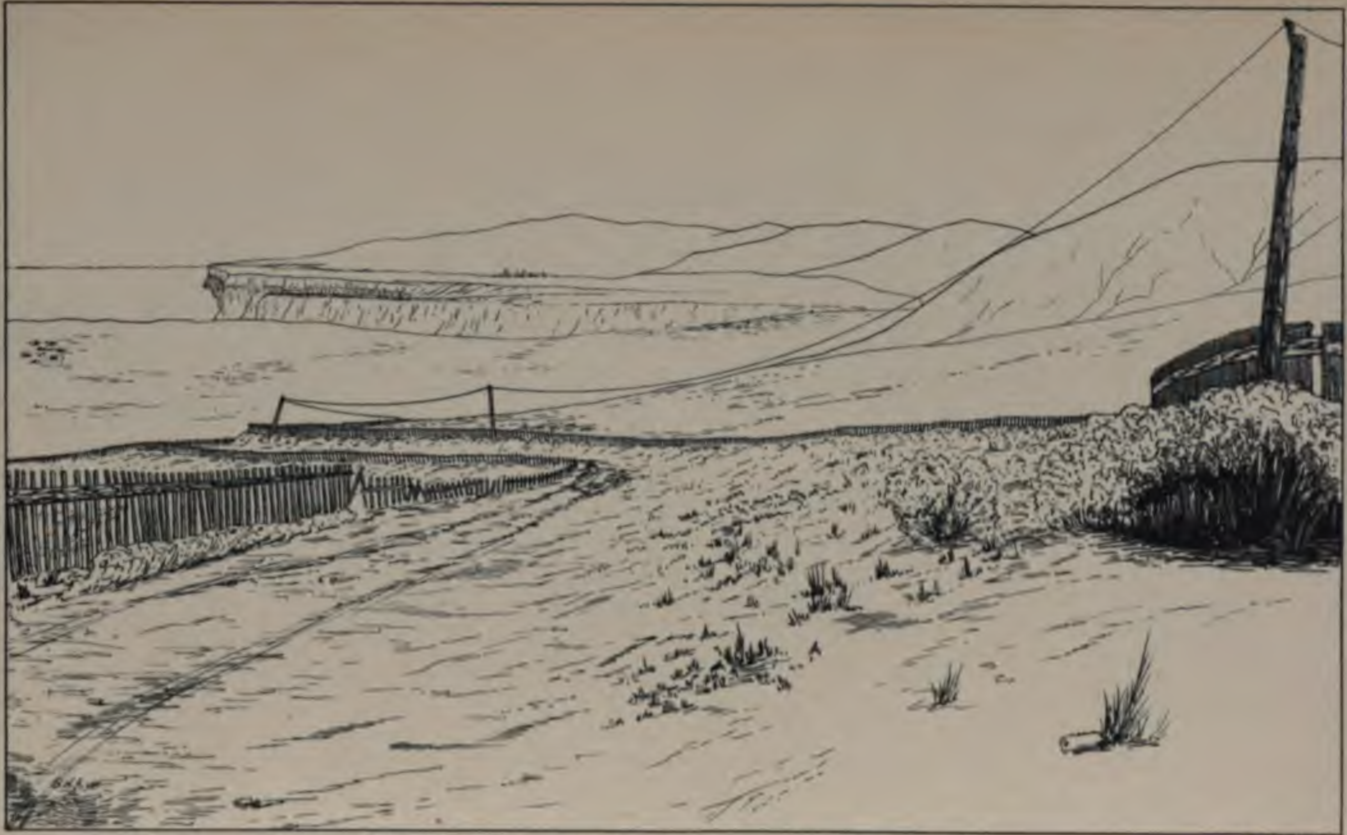
PLATE XXI.



E.A.S. del

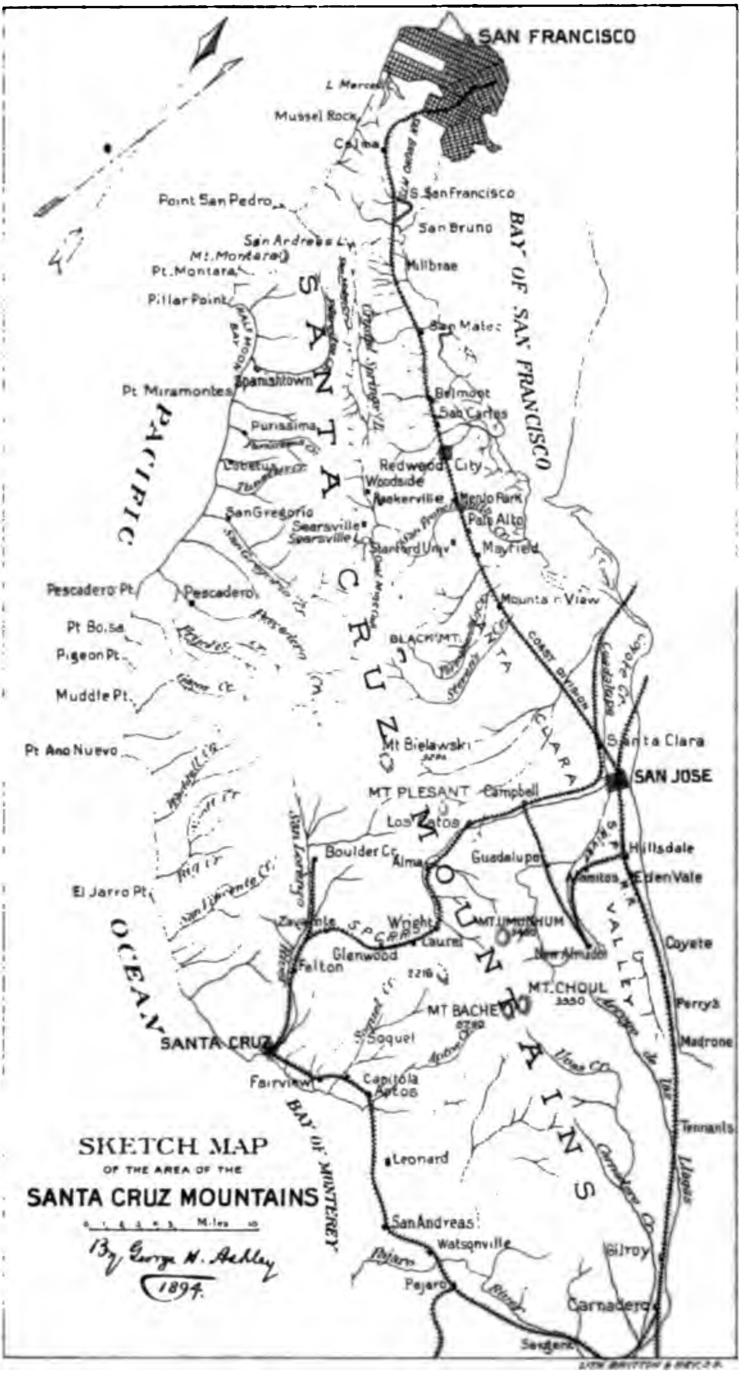
Lith Britton & Rey S.F.

PLATE XXII.



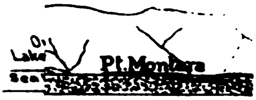
Raised Beach near Lobetus — Quaternary overlying Merced strata.

PLATE XXIII.

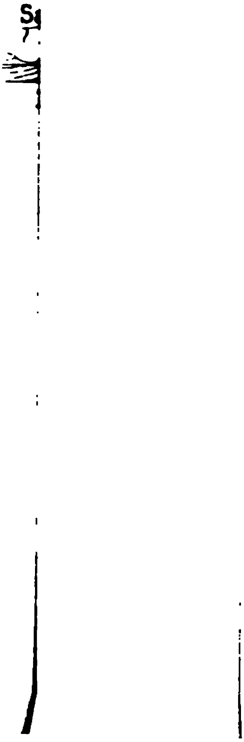


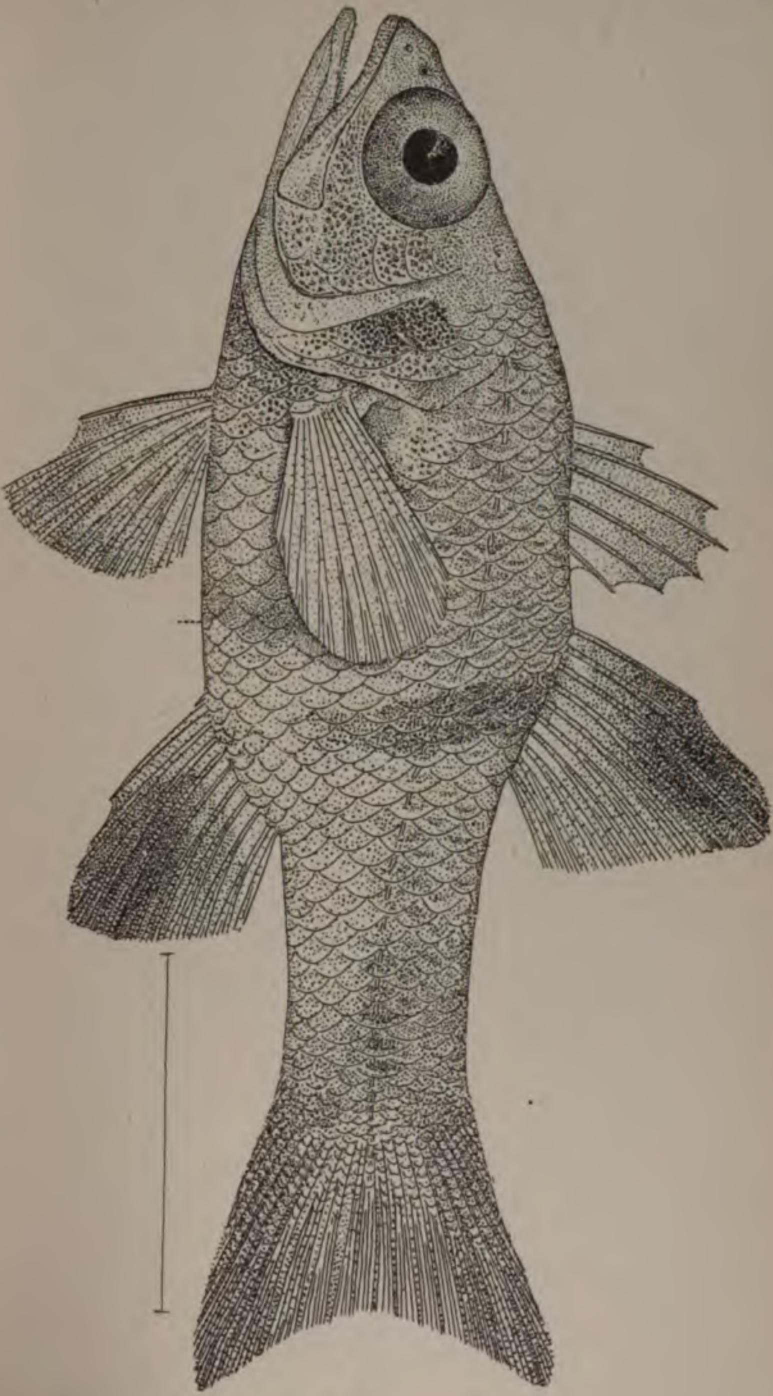
SKETCH MAP
OF THE AREA OF THE
SANTA CRUZ MOUNTAINS

By George H. Ashley
1894



twice the horisontal sca



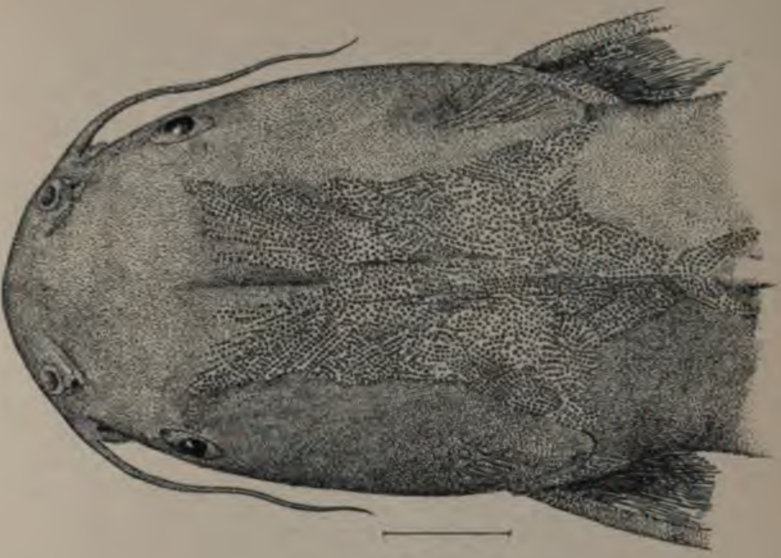


APOGON RETROSELLA.

[illegible] Del.

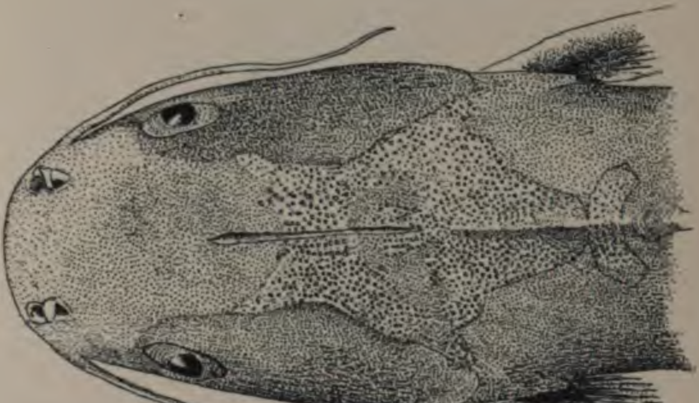
[illegible]

PLATE XXVII



GALEICHTHYS AZUREUS.

PLATE XXV

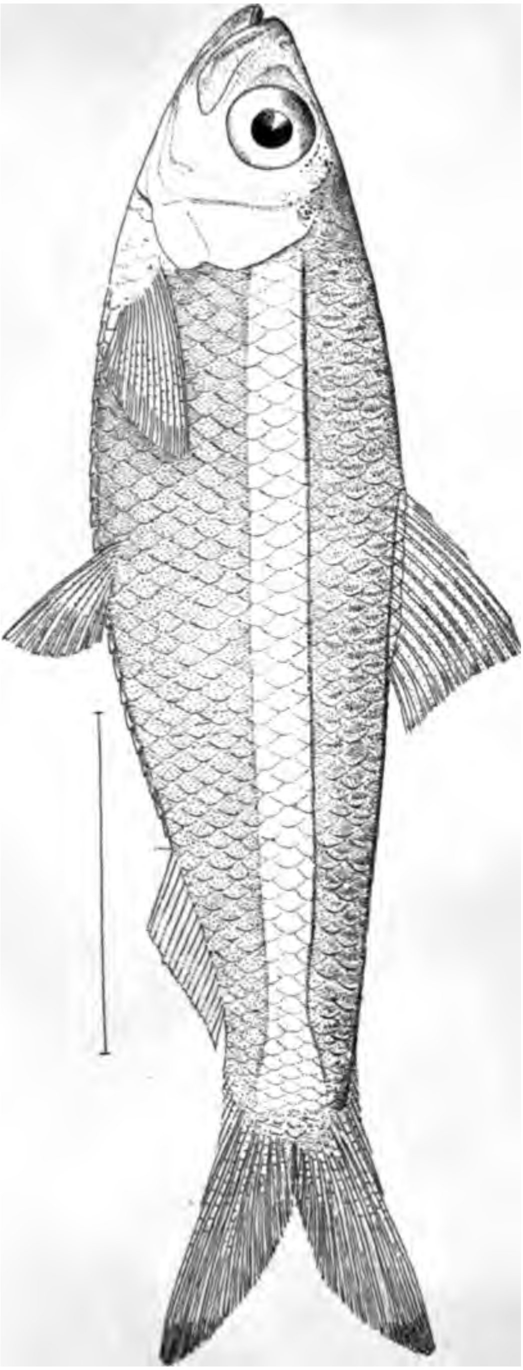


GALEICHTHYS GILBERTI.

Anna L. Brown Del.

LITH. BRITTON & REY,

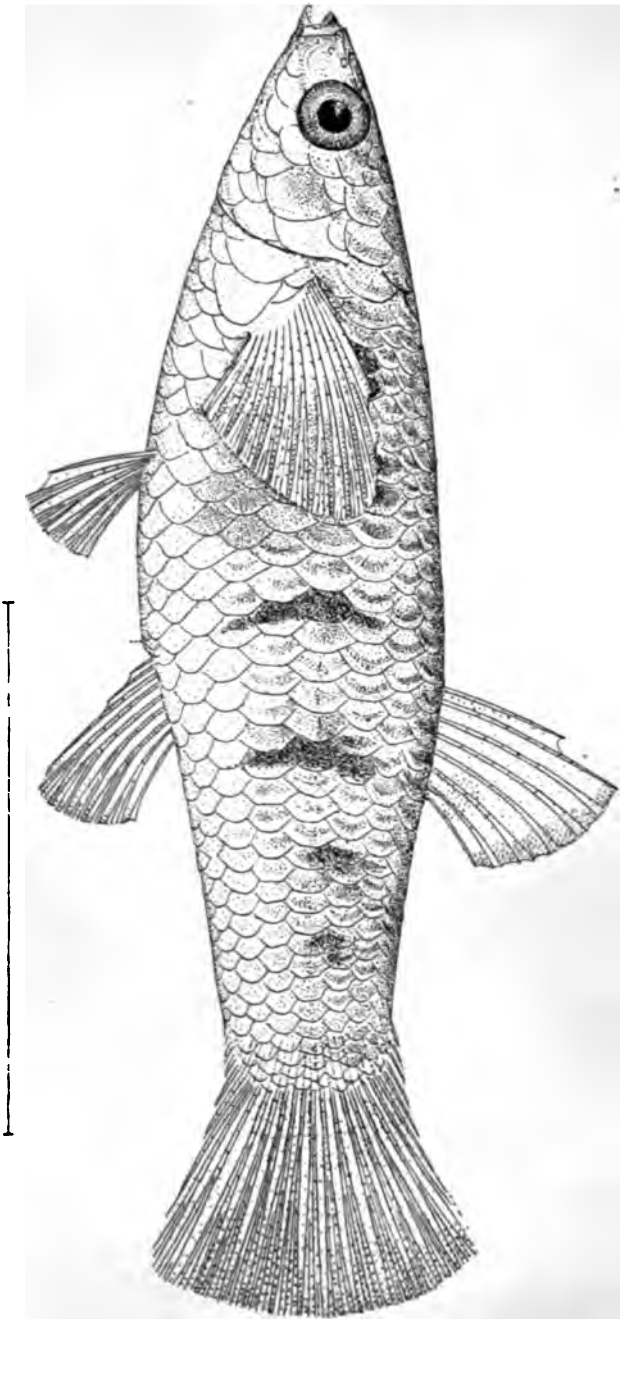
PLATE XXVIII



SARDINELLA STOLIFERA.

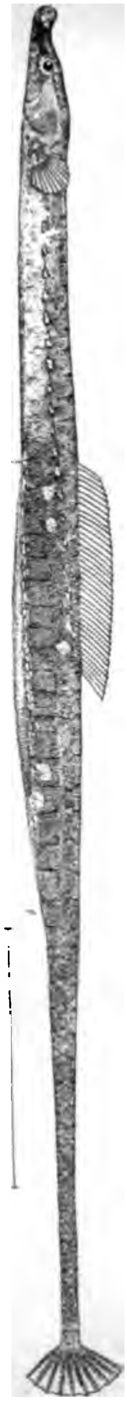
[illegible] LITH BRITTON & REY

PLATE XXIX.



PŒCILIA PRESIDIONIS.

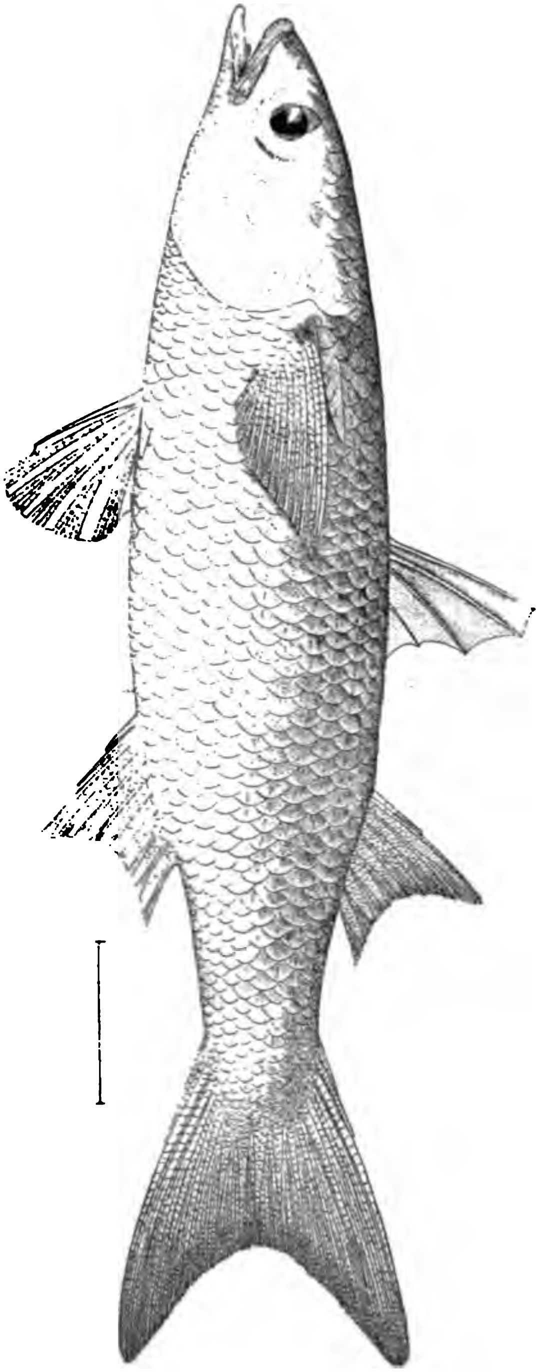
[illegible] del. [illegible]



SIPHOSTOMA STARKSII.

Anna L. Brown del.

LITH BRITTON &

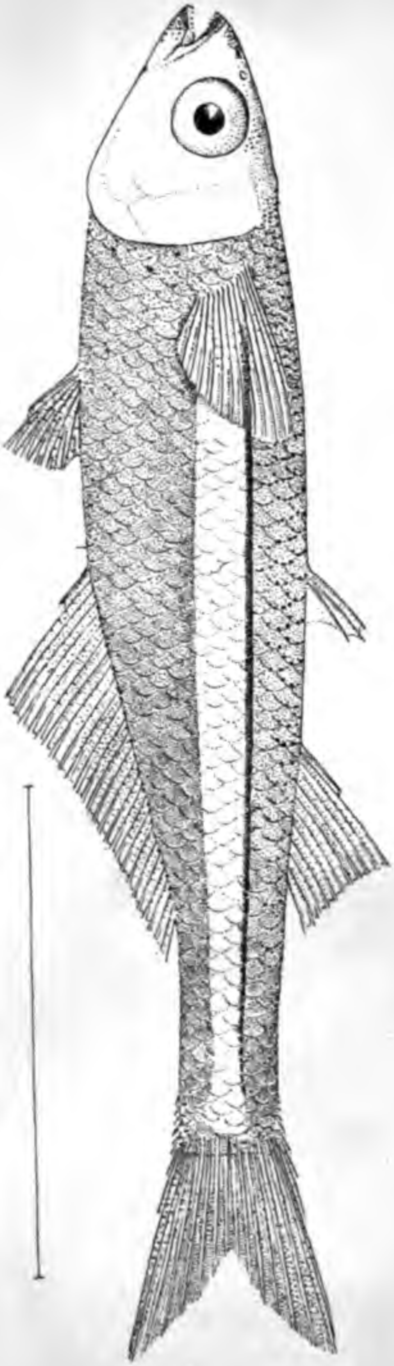


MUGIL HOSPES.

[illegible]

[illegible]

PLATE XXXII.

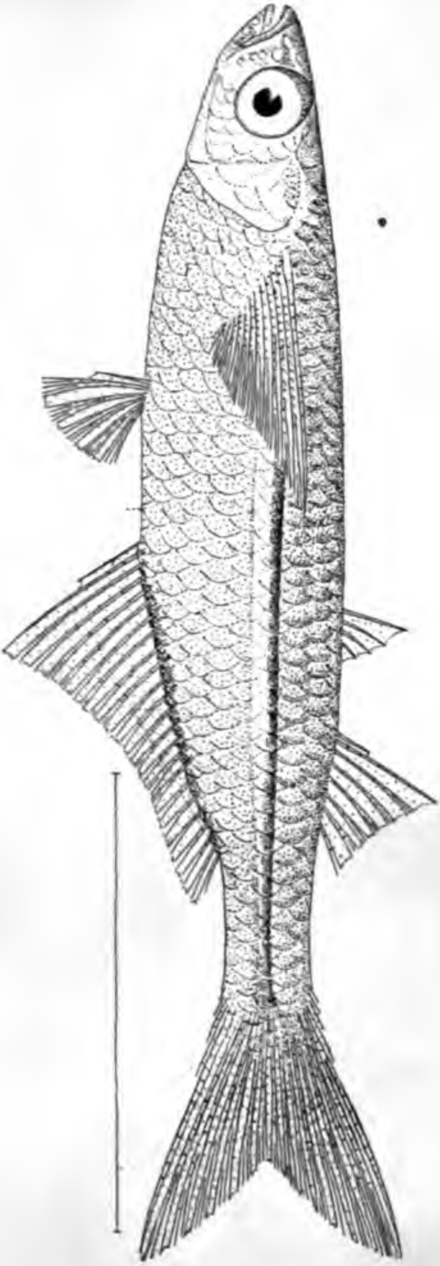


EURYSTOLE ERIARCHA.

[illegible] fec.

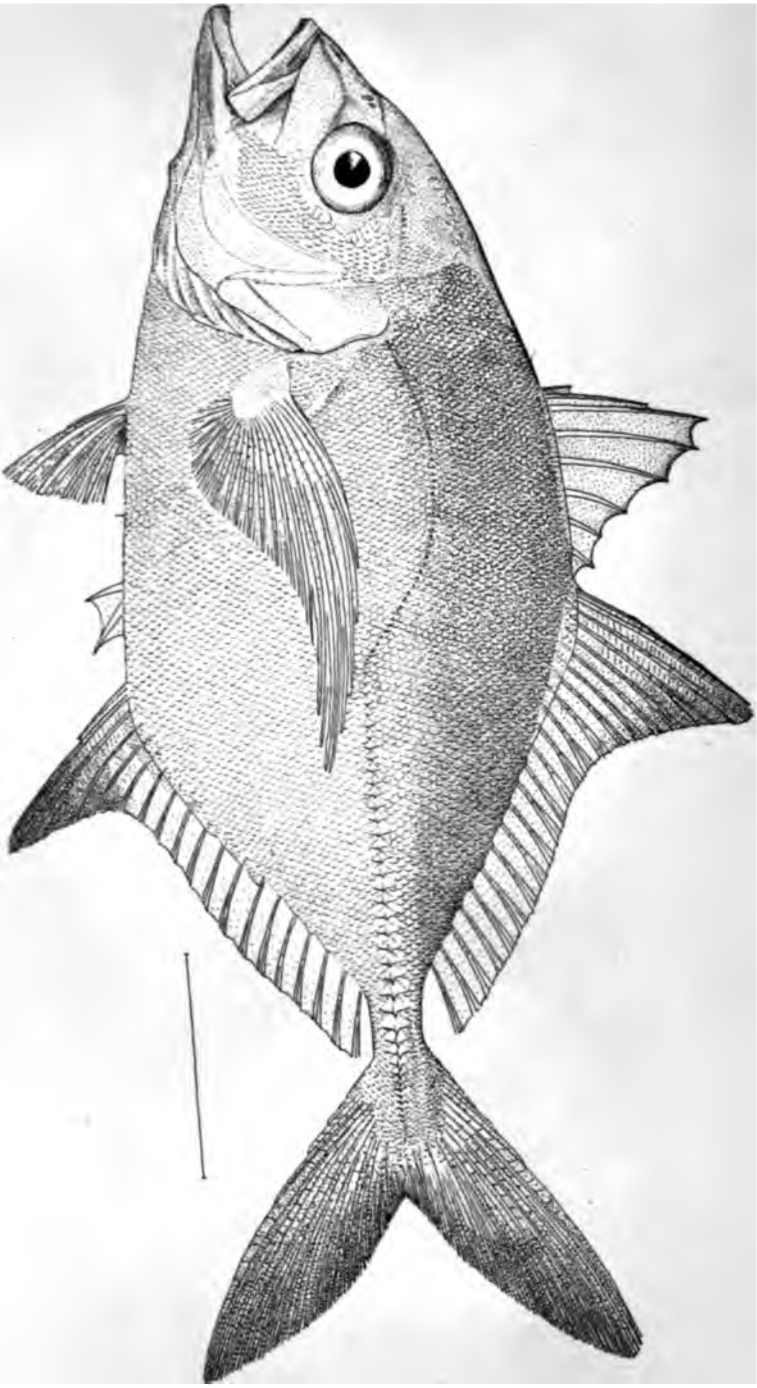
[illegible]

PLATE XXXIII



[illegible] THYRINA EVERMANNI. [illegible]

PLATE XXXIV.

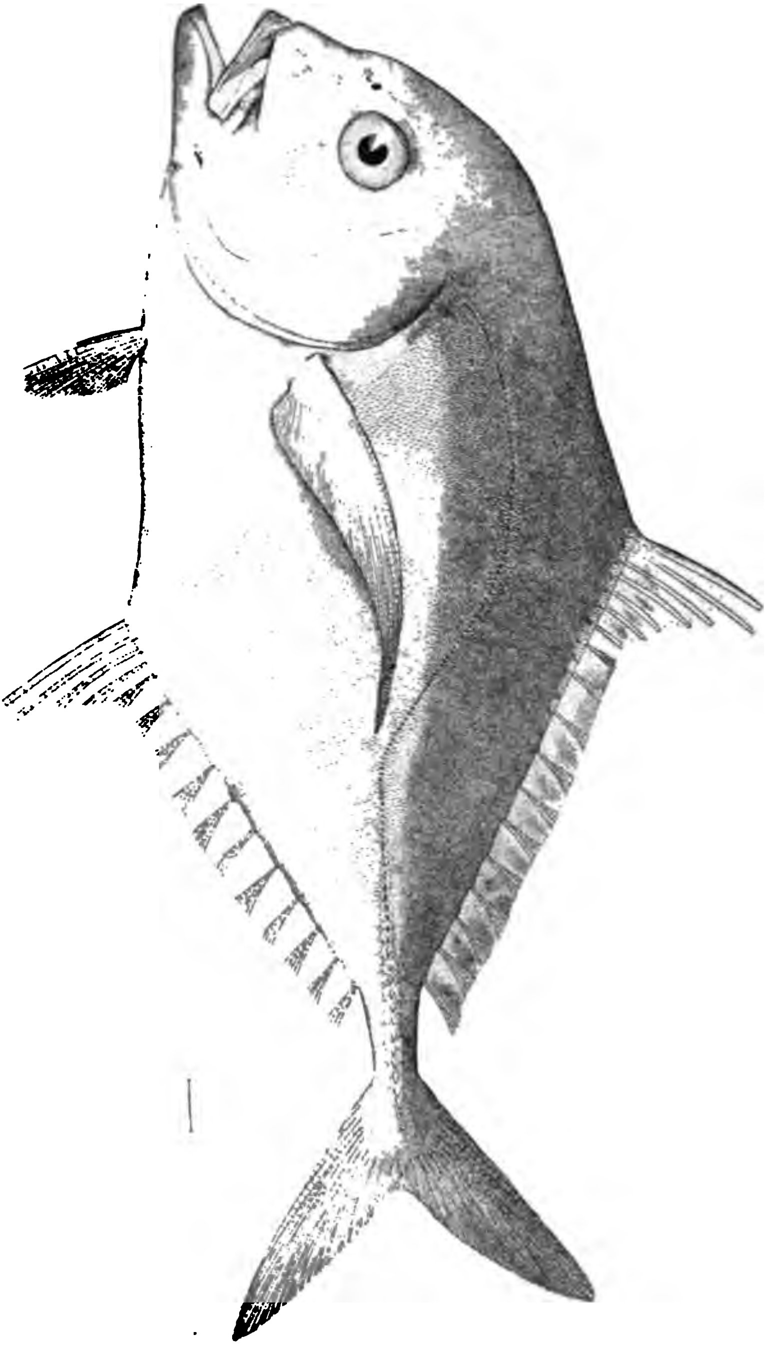


CARANX MEDUSICOLA.

Anna L. Brown, Del.

LITH.

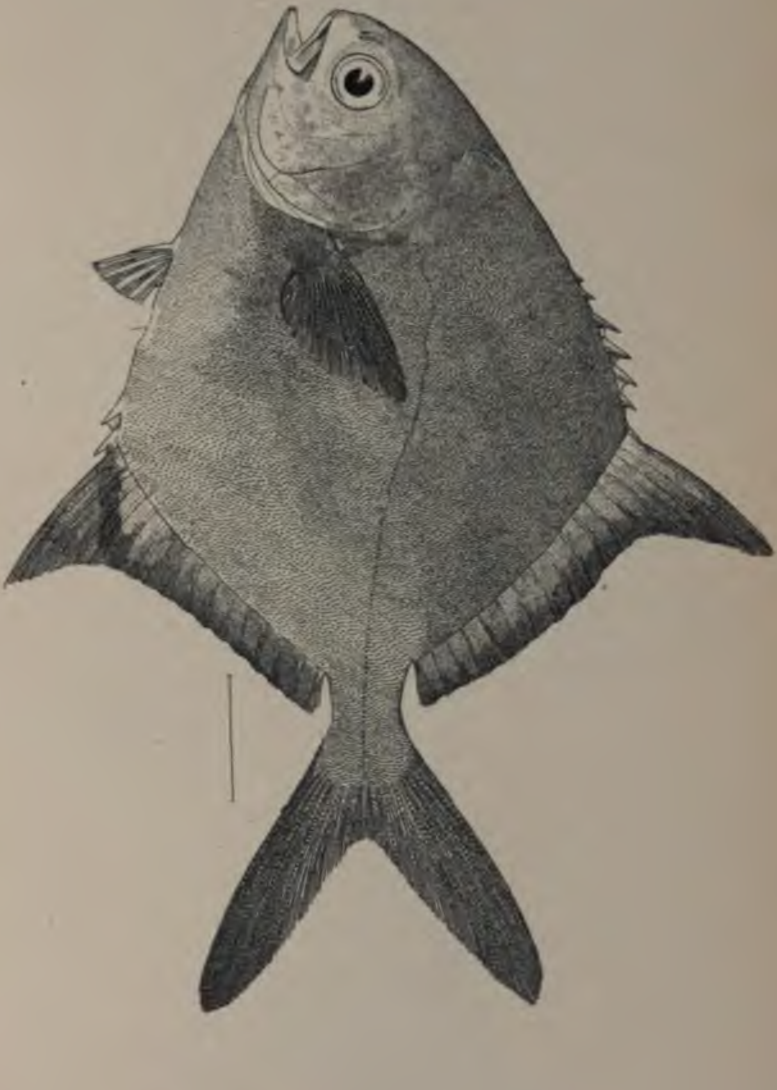
PLATE XXXV



HYNNIS HOPKINSI.

[illegible]

[illegible]

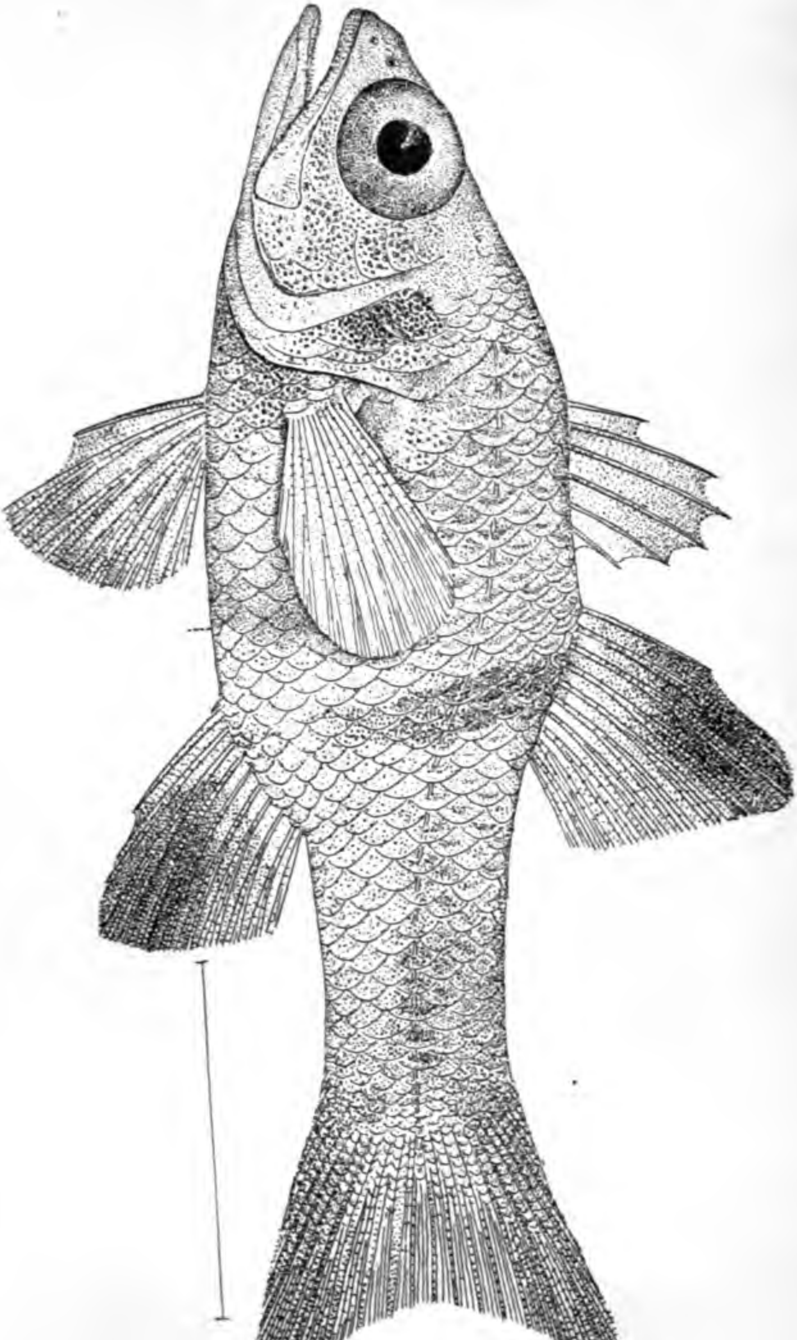


TRACHINOTUS CULVERI.

Annie L. Brown Del.

LITH. [illegible]

PLATE XXXVII.

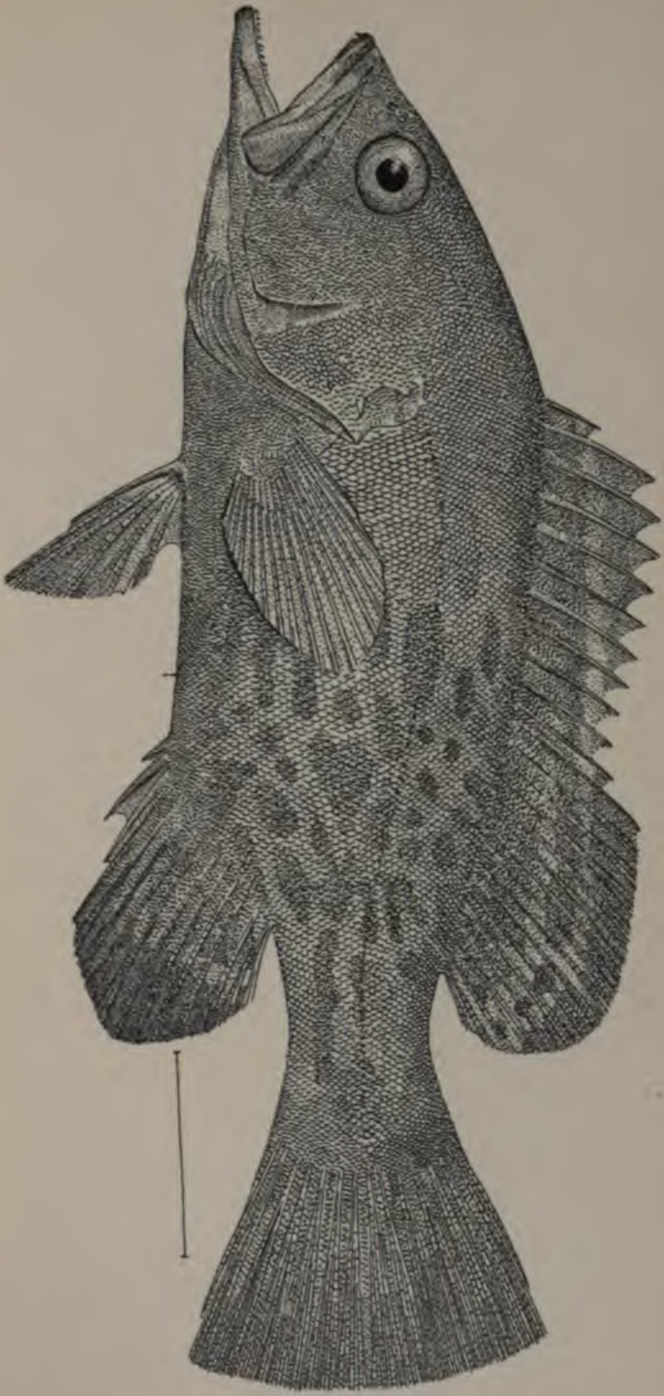


APOGON RETROSELLA.

[illegible] Del.

Lith.

PLATE XXXVIII

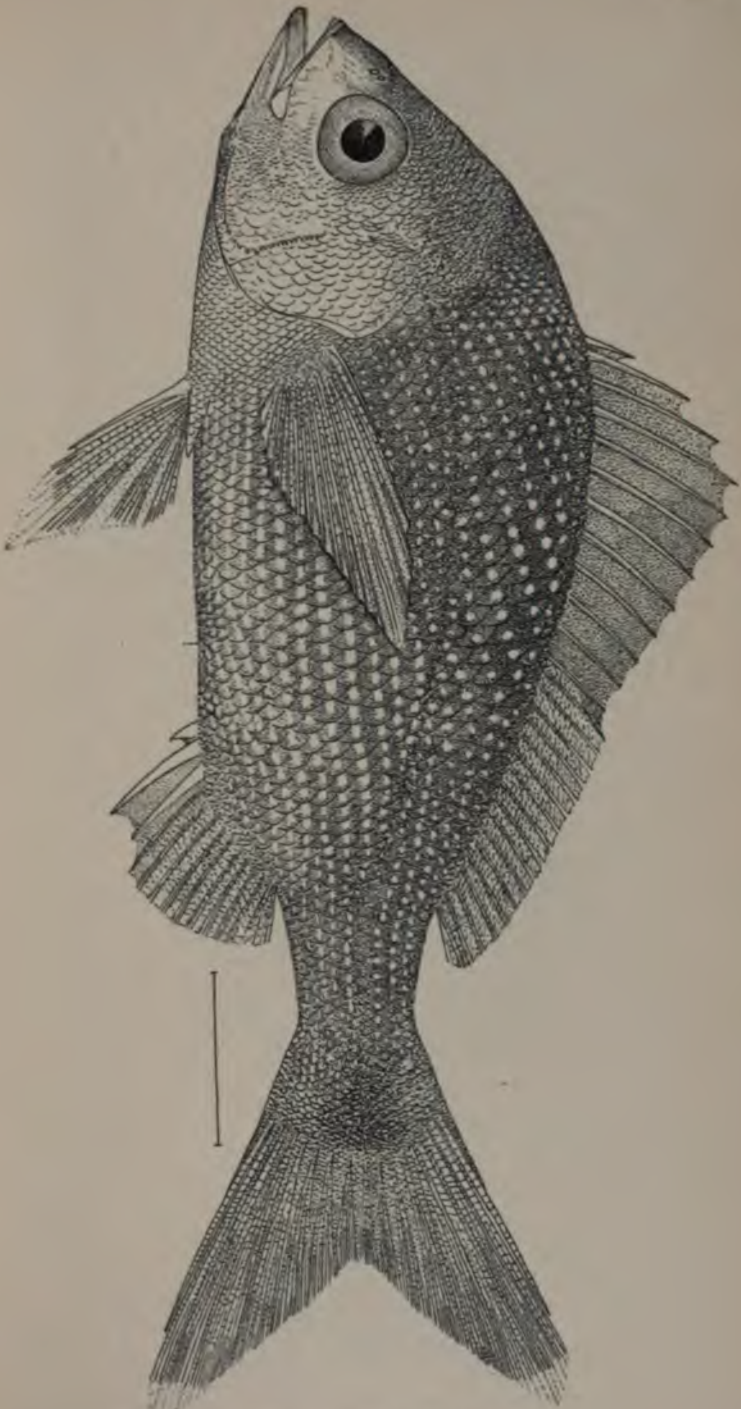


MYCTEROPERCA BOULENGERI.

[illegible]

[illegible]

PLATE XL.

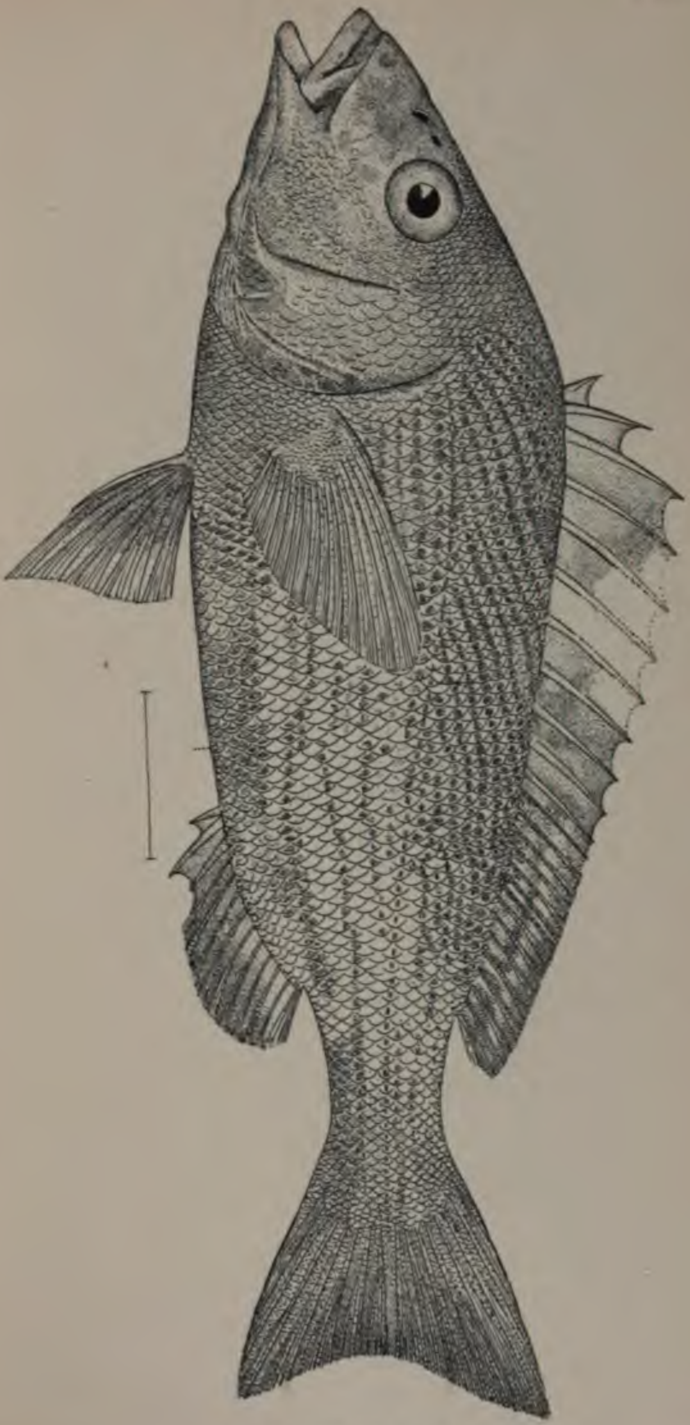


LYTHRULON OPALESCENS.

Annie L. [illegible] Del.

[illegible]

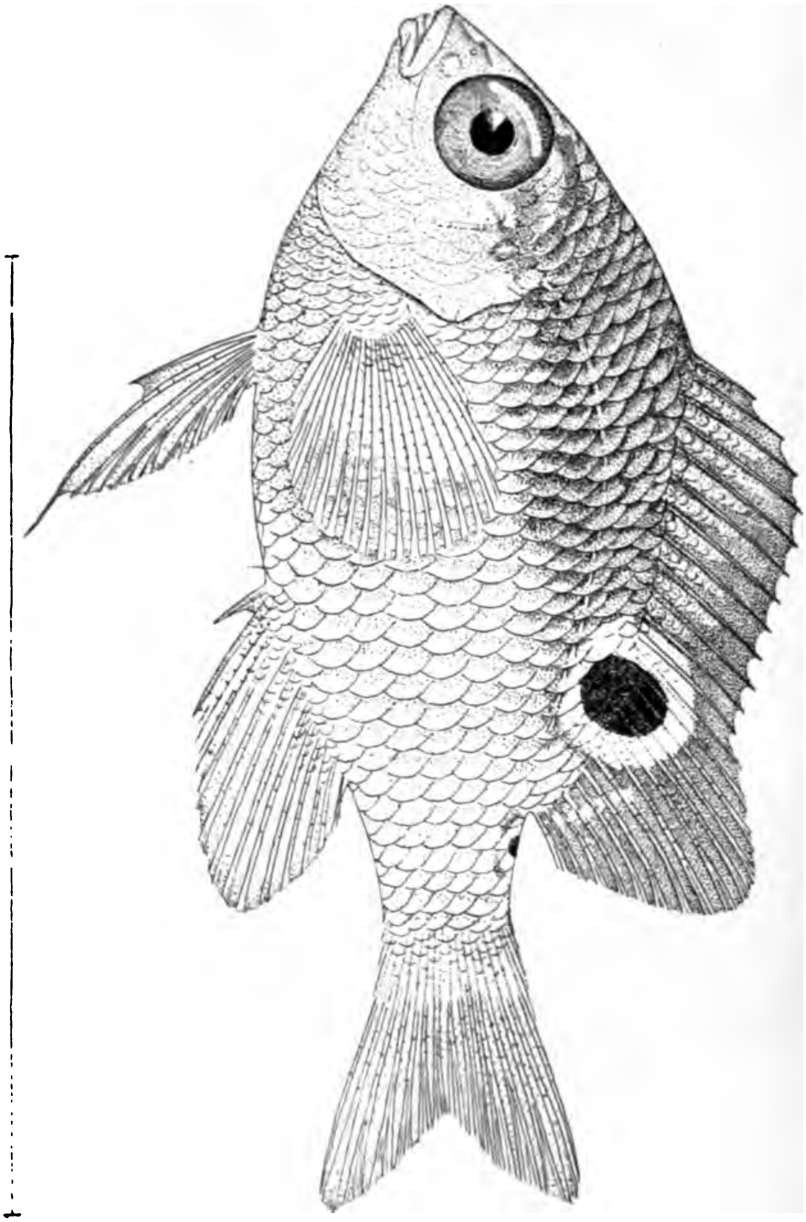
PLATE XLI.



ORTHOPRISTIS REDDINGI.

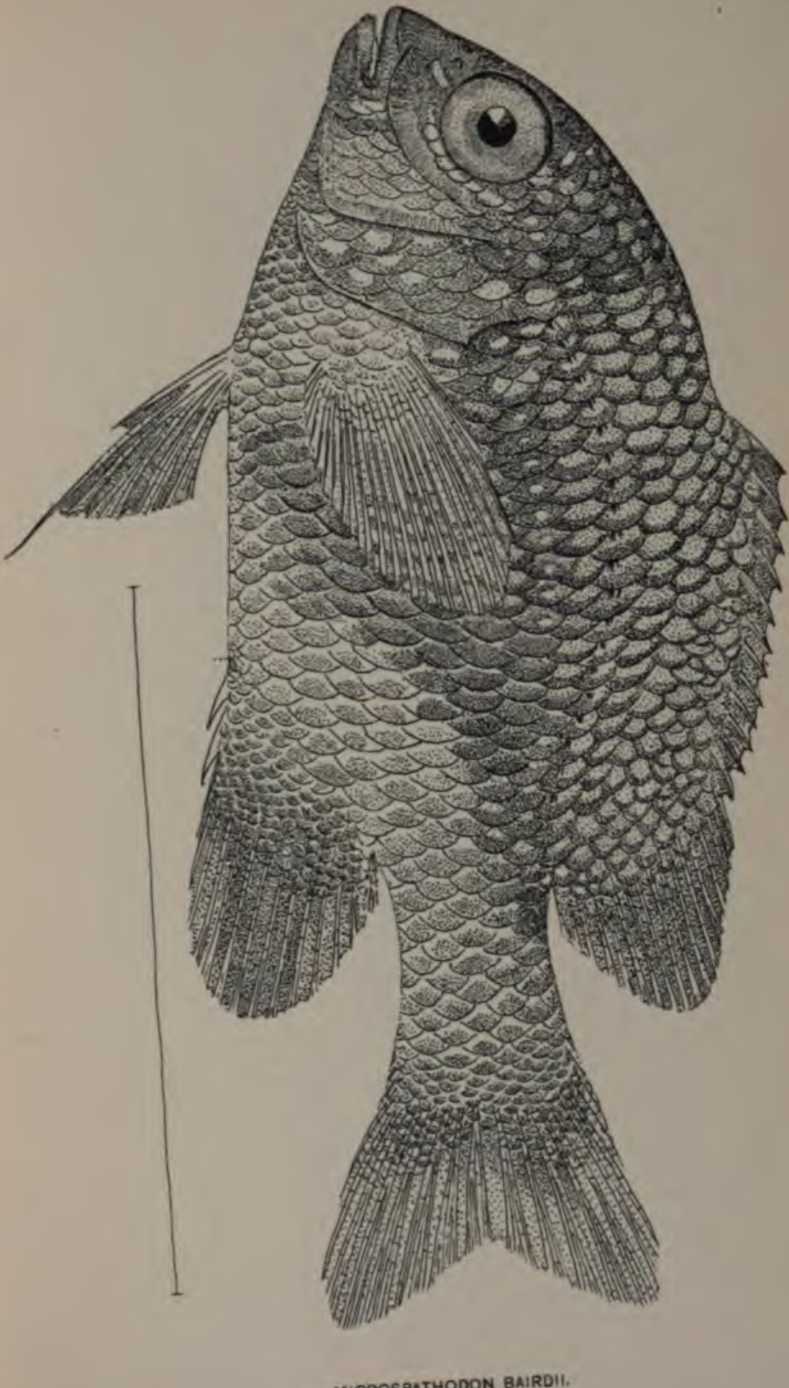
[illegible] Del.

[illegible]



EUPOMACENTRUS FLAVILATUS.

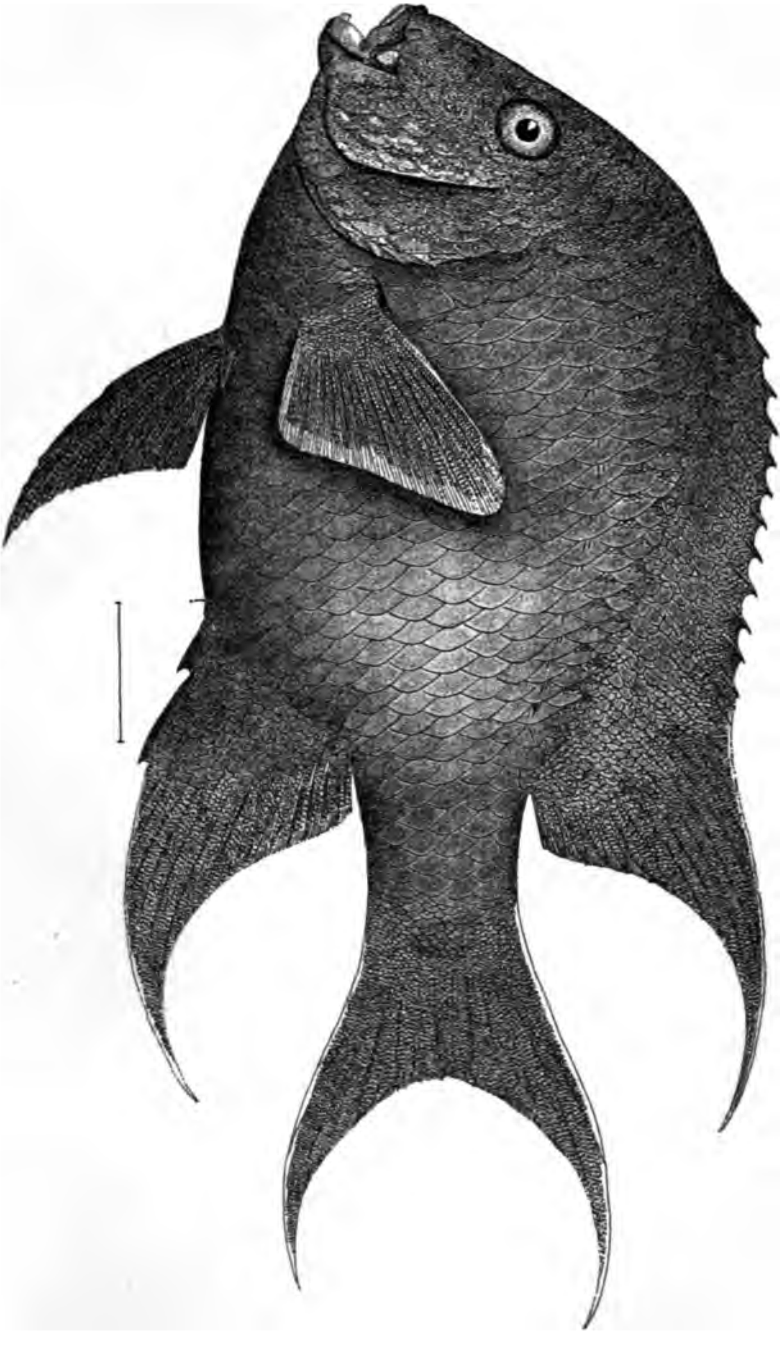
[illegible] LITH. BRITTO



MICROSPATHODON BAIRDII.

Anna L. Barrows, Del.

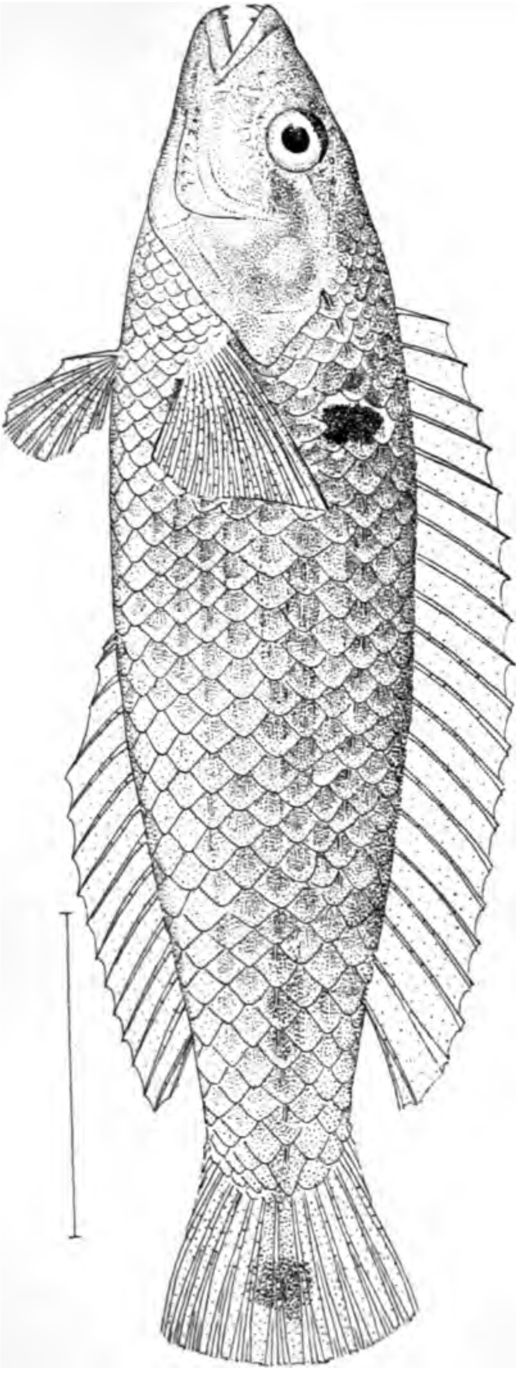
PLATE XLIV.



MICROSPATHODON AZURISSIMUS.

Anna L. Brown Del.

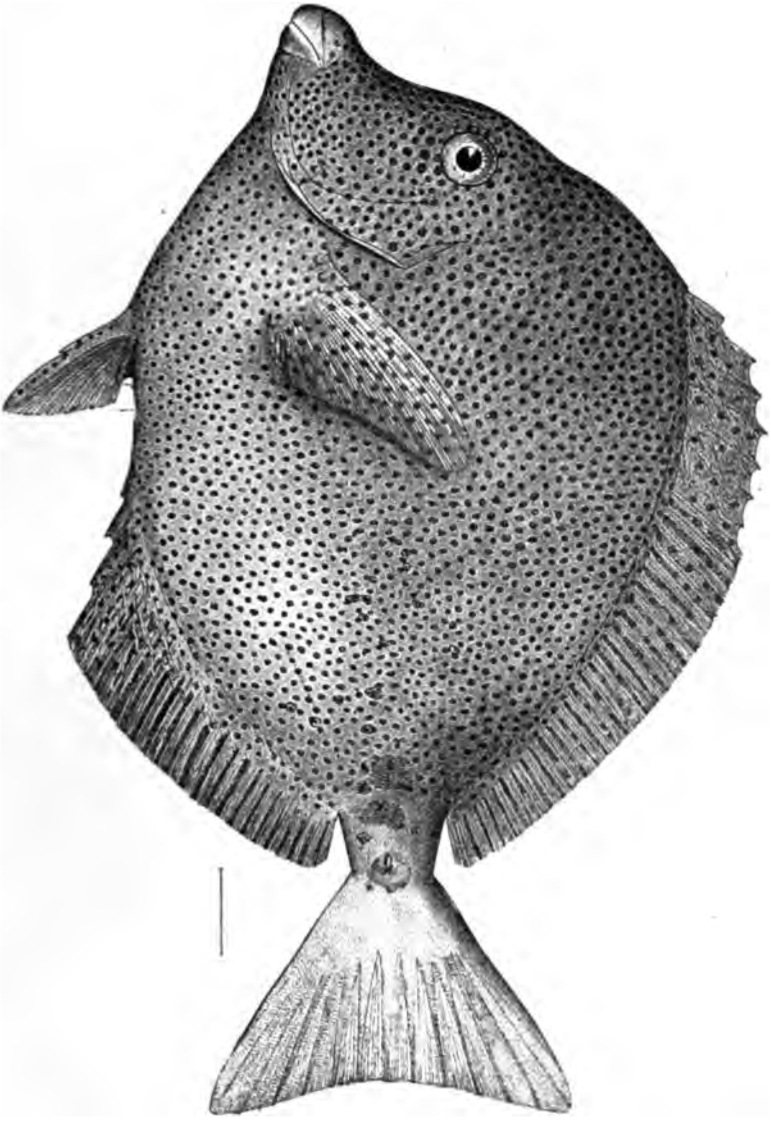
Lith. Britton & Rey.



HALICHŒRES DISPILUS.

Anna L. Brown Del.

LITH BRITTON

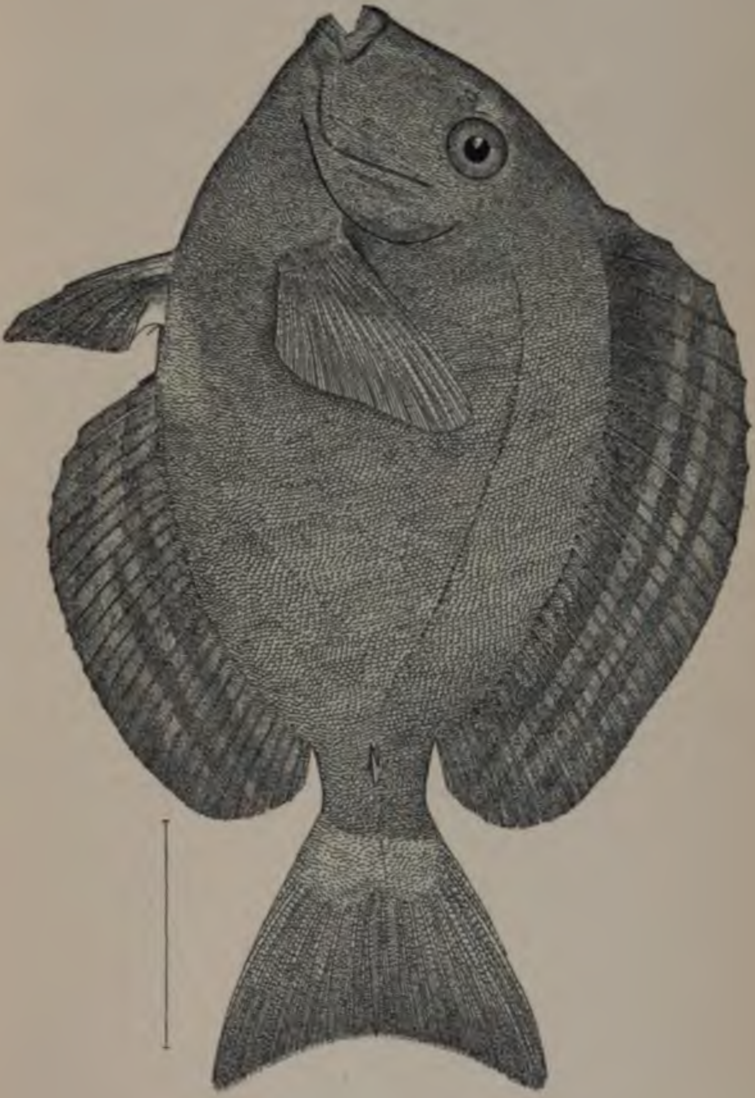


XESURUS PUNCTATUS.

L. Brown, Del.

Lith. Britton & Rey, S.F.

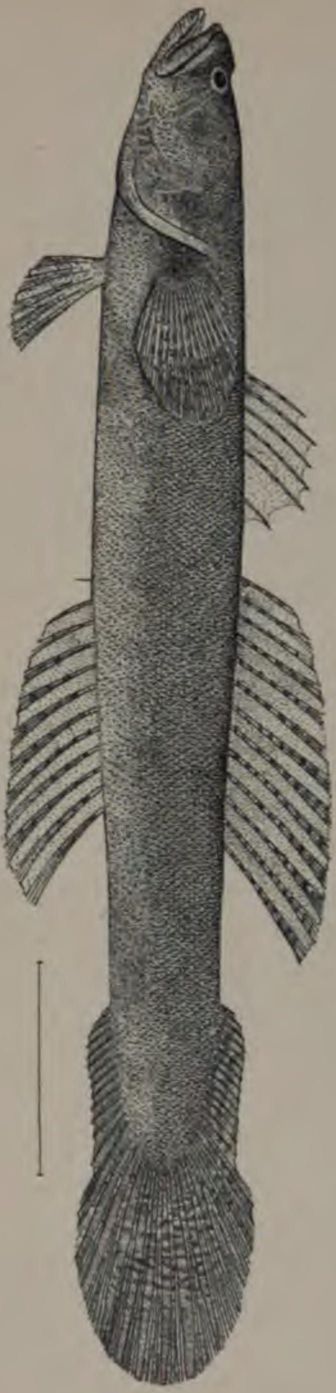
PLATE XLVII.



TEUTHIS CRESTONIS.

L. Brown, Del.

LITH. BRITTON & REY. S.F.

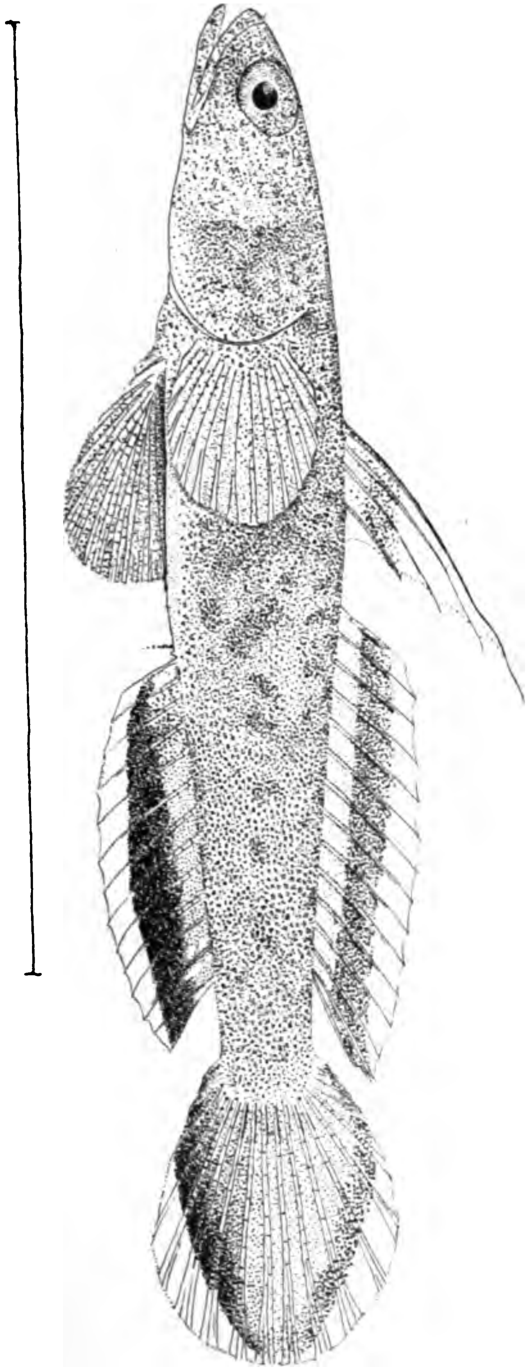


ALEXURUS ARMIGER.

L. Brown Del.

LITH. MINTERN BROS.

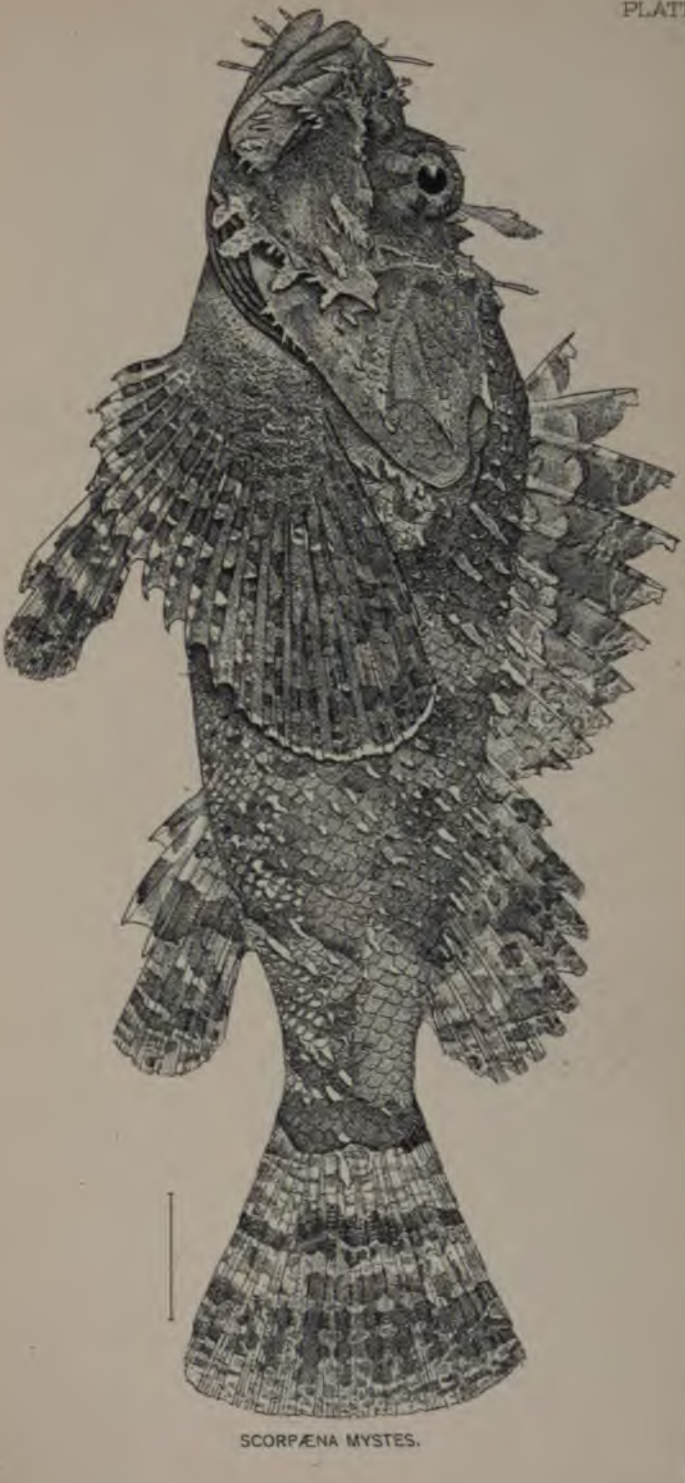
PLATE LI.



EVERMANNIA ZOSTERURA

[illegible] Del.

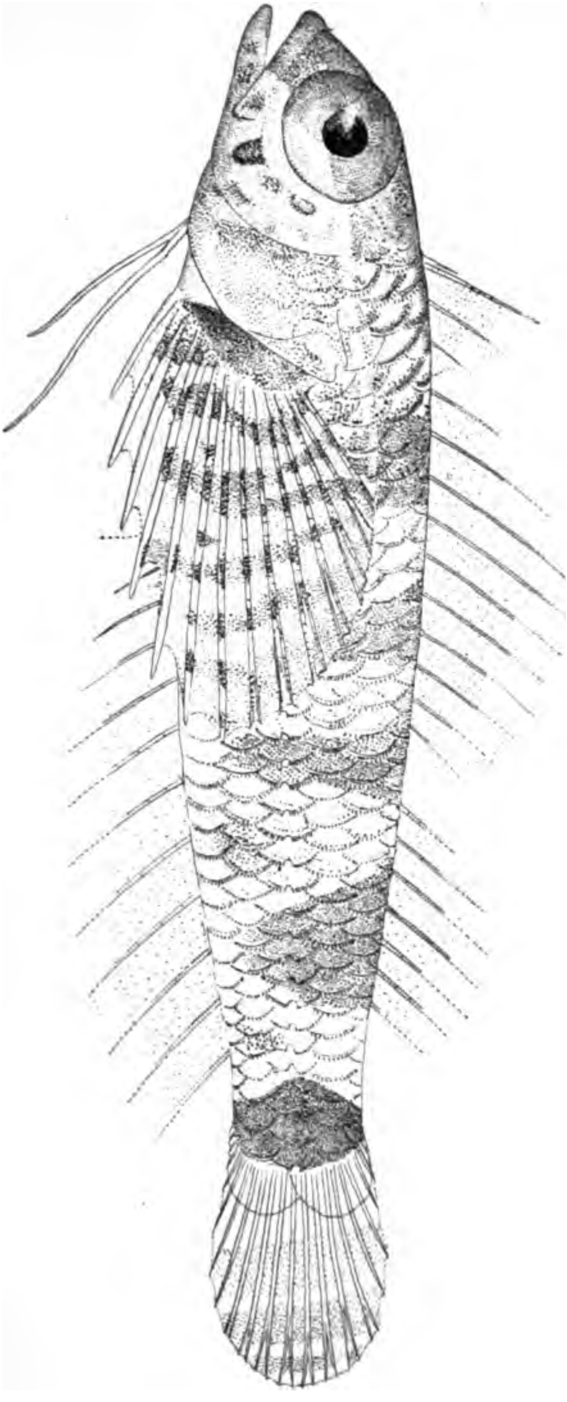
[illegible]



SCORPÆNA MYSTES.

[illegible] Del.

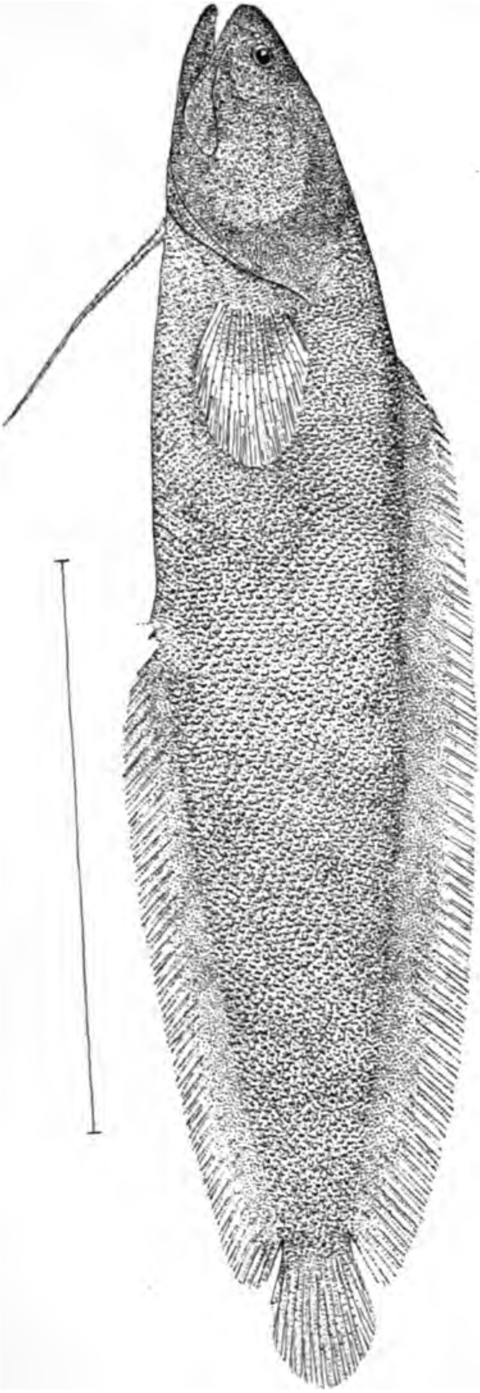
[illegible]



ENNEANECTES CARMINALIS

Anna L. Brown, Del.

LITH. BRITTON & REY

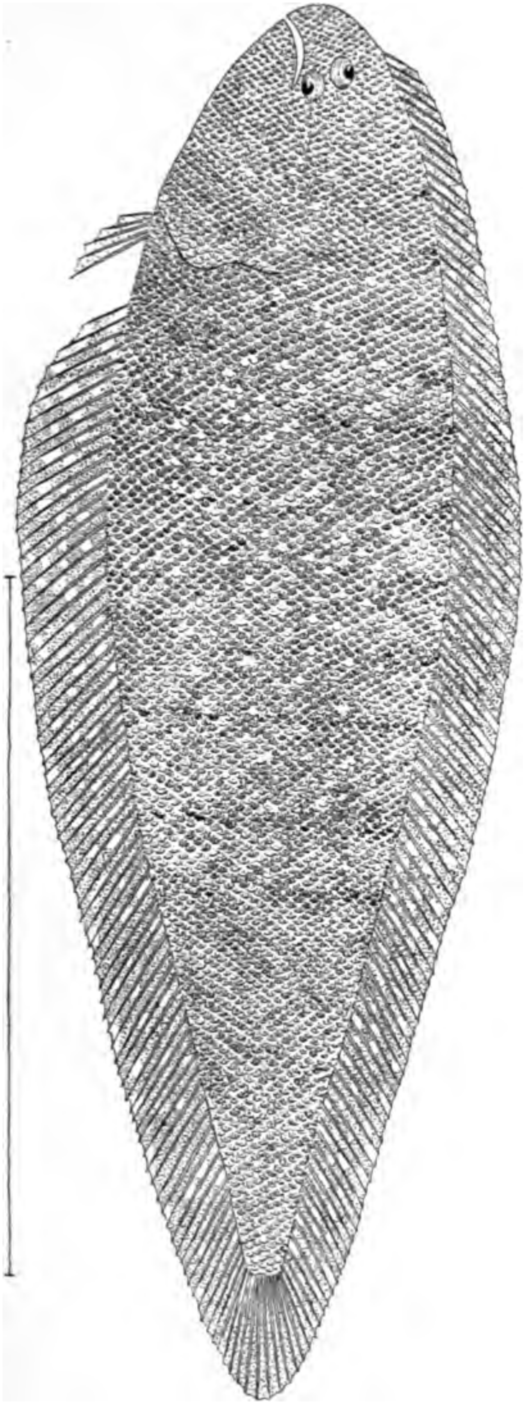


DINEMATICHTHYS VENTRALIS.

LITH. [illegible]

Anna L. Brown Del.

PLATE LV

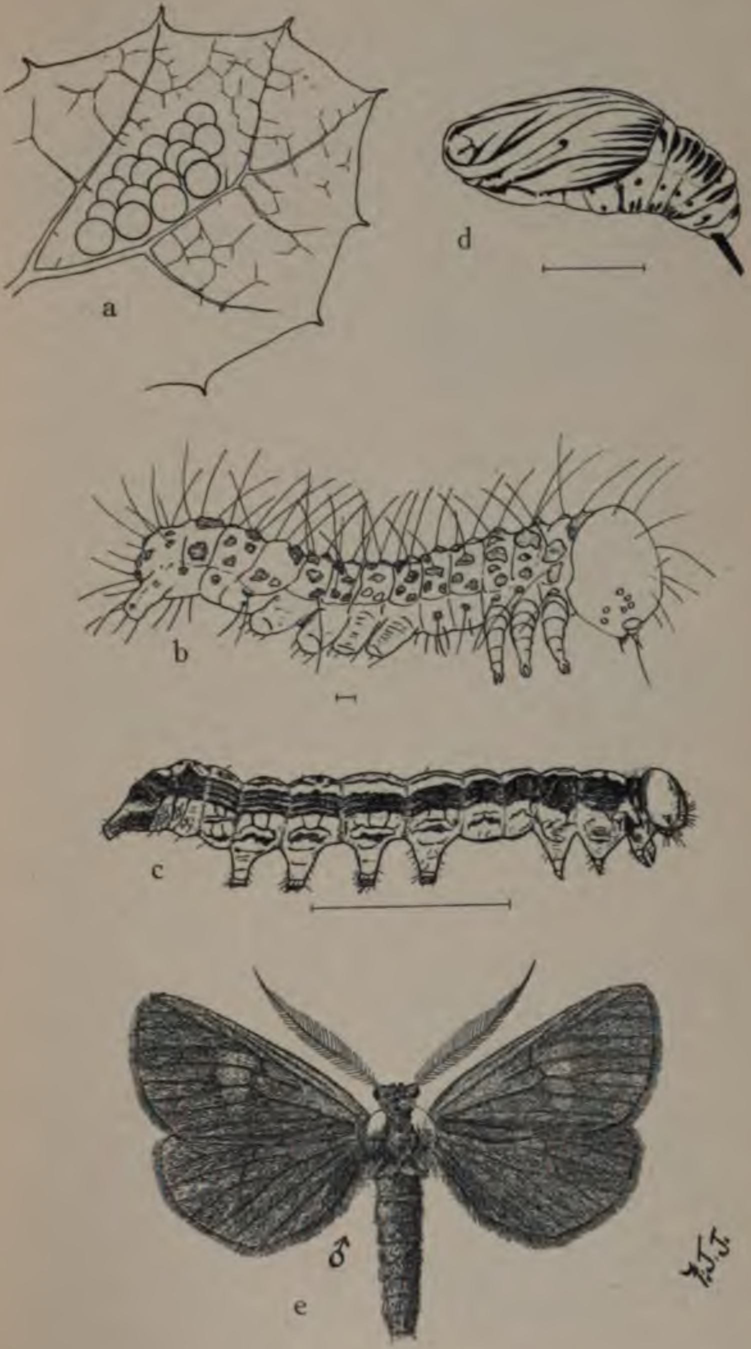


SYMPHURUS WILLIAMSI.

Brown Del.

Lith. Britton & Rey.

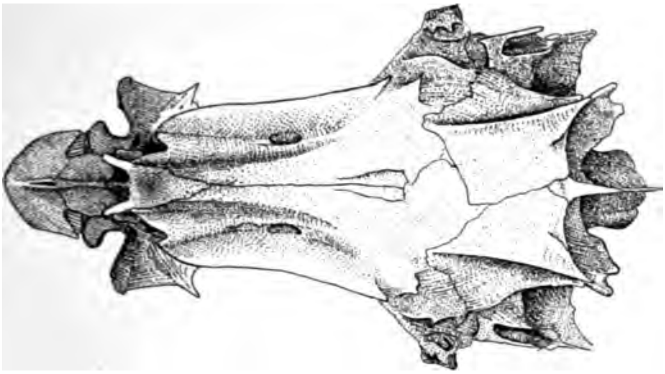
PLATE LVI.



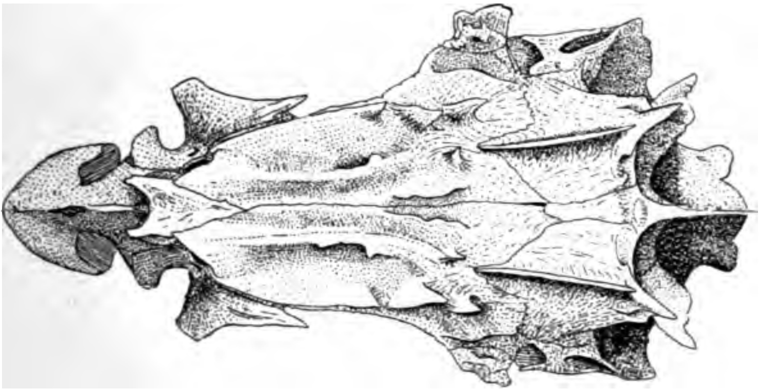
PHRYGANIDIA CALIFORNICA Pack.

A, eggs; B. larva, first stage; C, larva, sixth stage; D. pupa; E. imago, male.

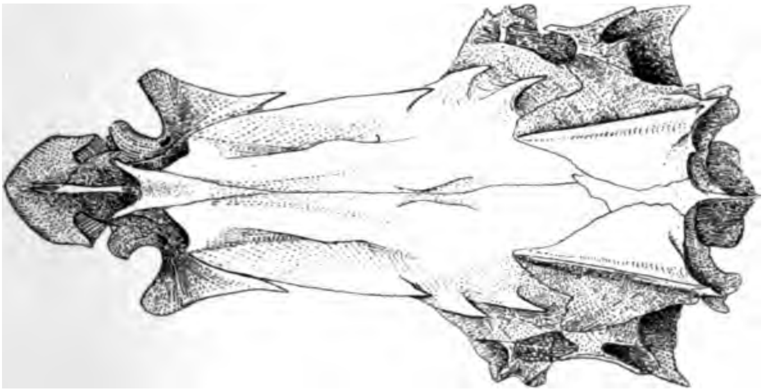
PLATE LXI



13. SEBASTODES DIPLOPROA



14. SEBASTODES INTRONIGER

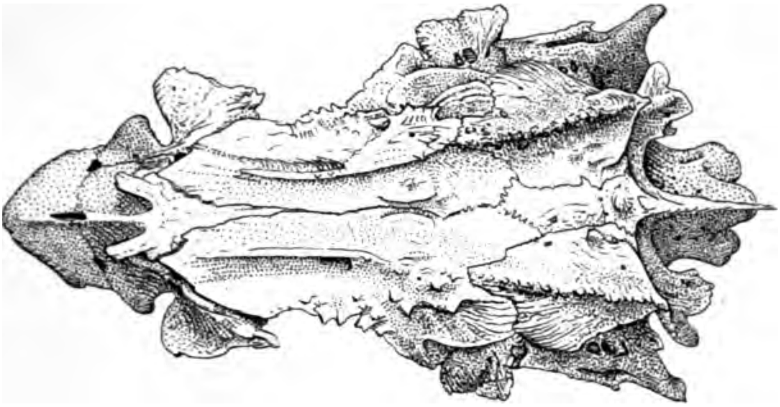


15. SEBASTODES AURORA

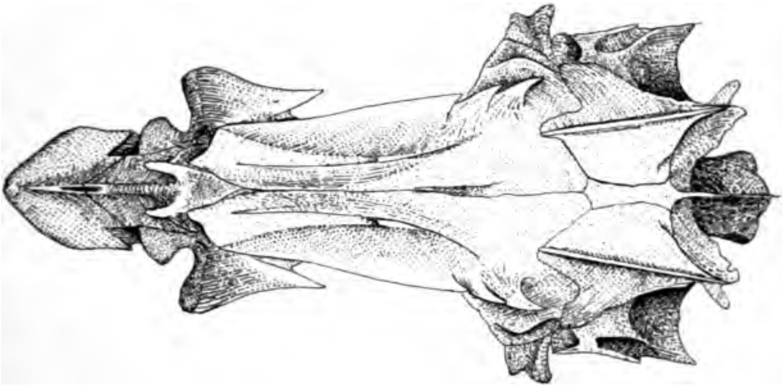
Del.

LITH. BRITTON & REY

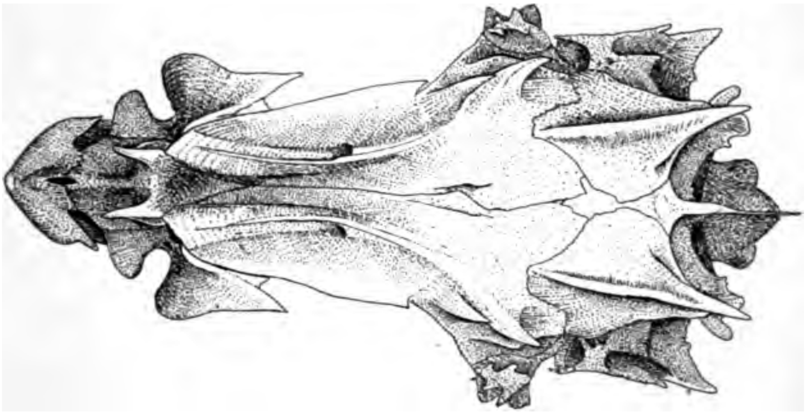
PLATE LXIII



19. SEBASTODES RUBERRIMUS



20. SEBASTODES ROSACEUS

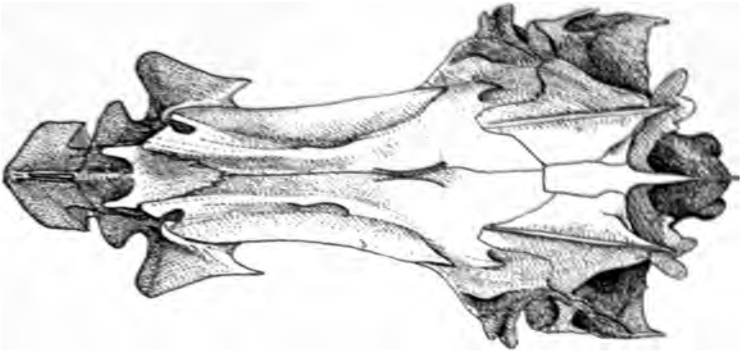


21. SEBASTODES CHLOROSTICTUS

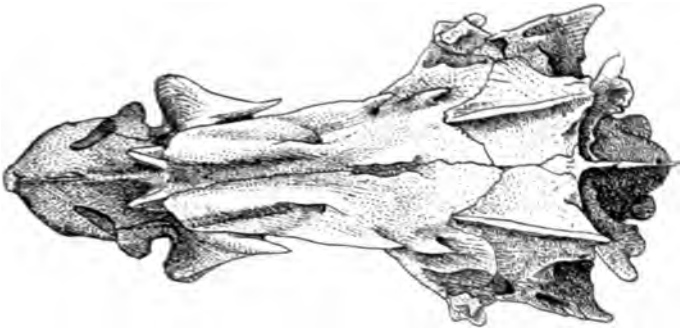
L. Brown Del.

Lith. Britton &

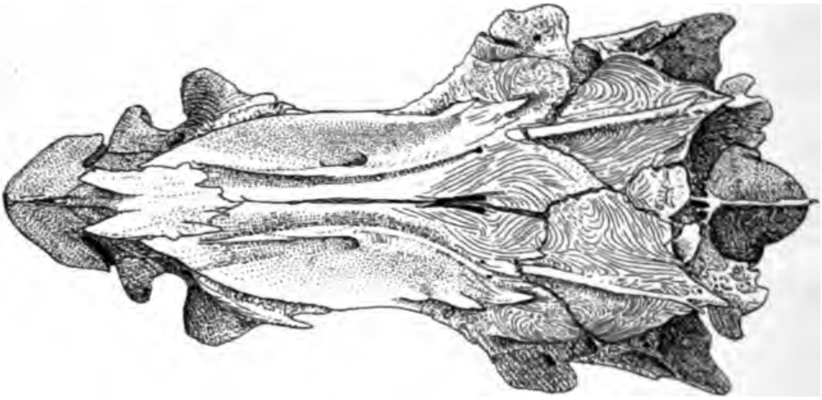
PLATE LXV



22. SEBASTODES ELONGATUS



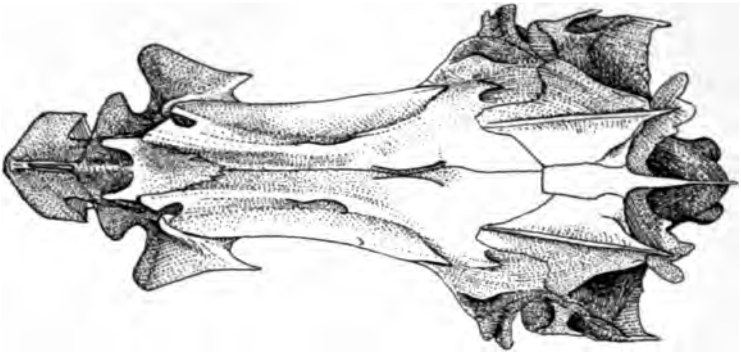
23. SEBASTODES RUBRIVINCTUS



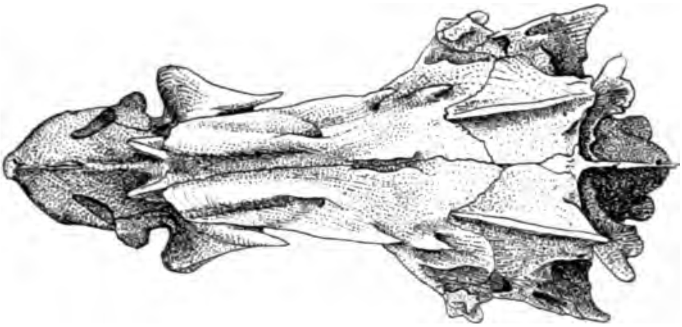
24. SEBASTODE

[illegible] L. Brown, Del.

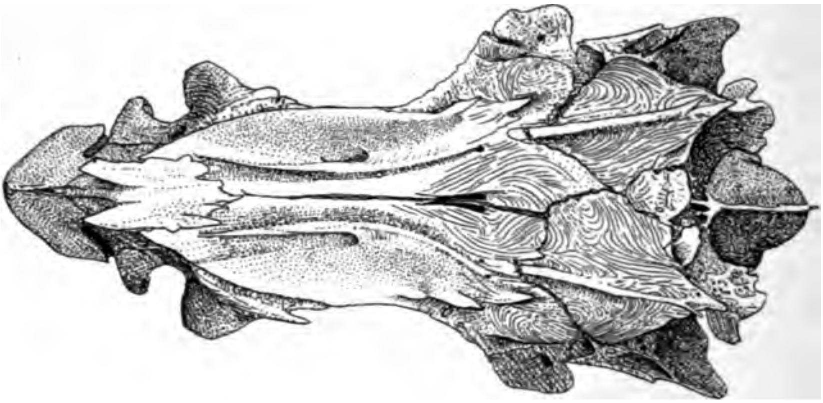
Lith. Britton



22. SEBASTODES ELONGATUS



23. SEBASTODES RUBRIVINCTUS

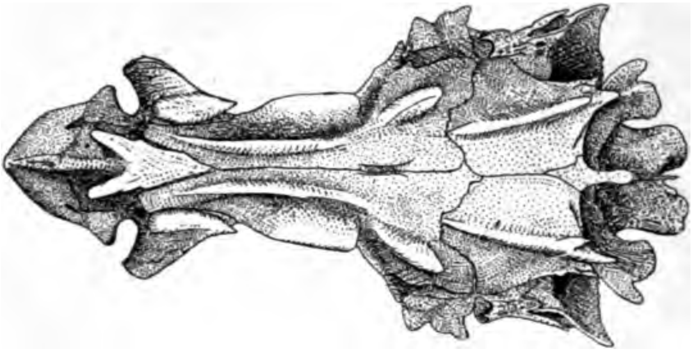


24. SEBASTODES LEVIS

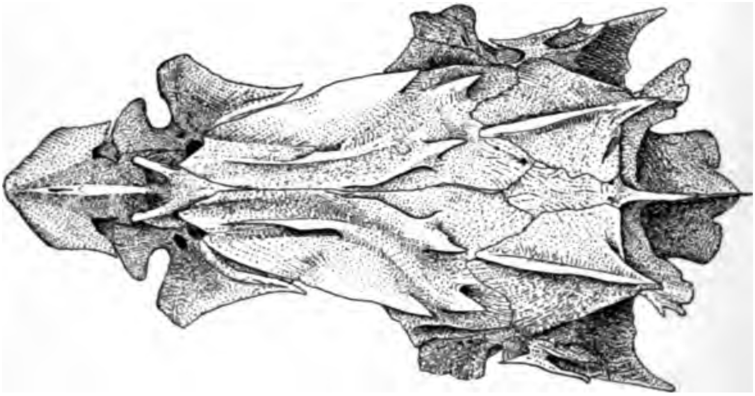
a L. Brown Del.

Lith. Britton & Rey. S.F.

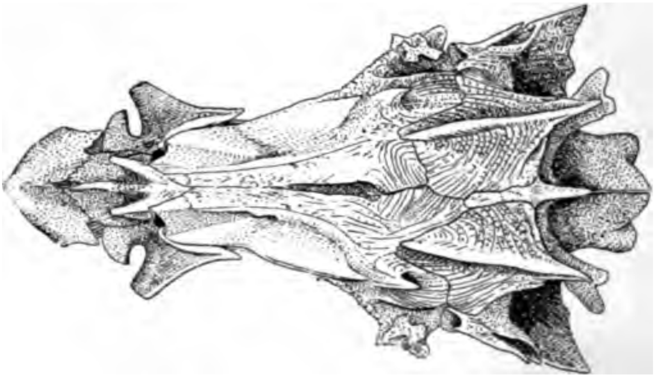
PLATE LXV



25. SEBASTODES SERRICEPS



26. SEBASTODES AURICULATUS

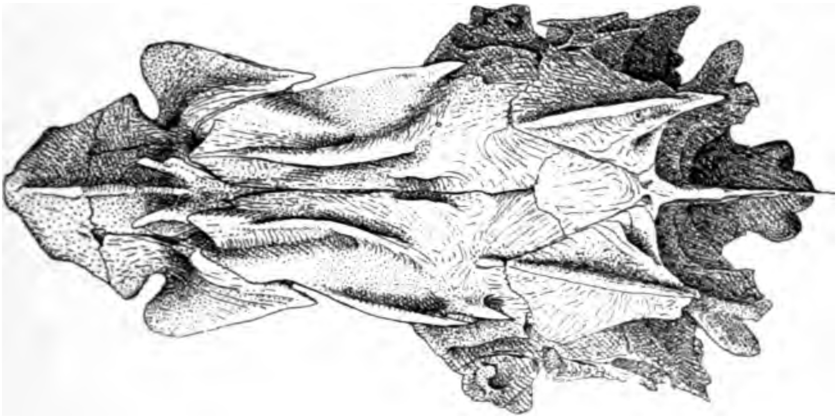


27. SEBASTODES RASTRELLIGER

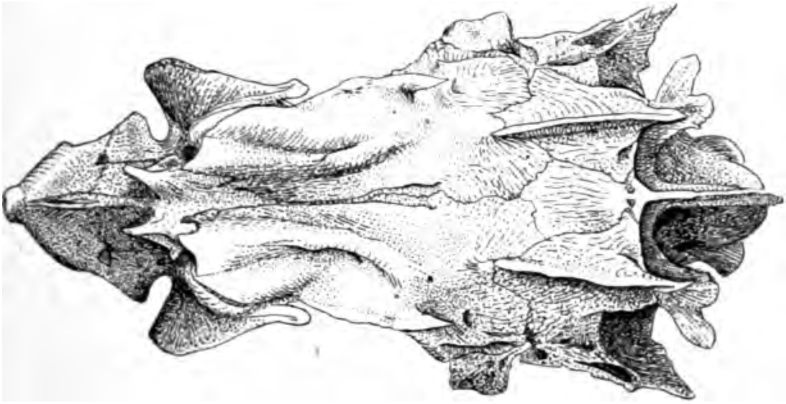
[illegible] Del.

LITH. BRITTON &

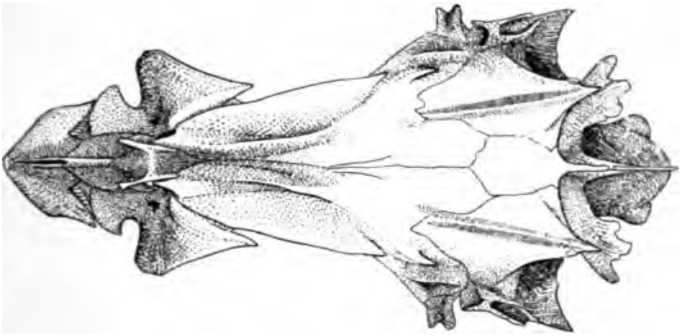
PLATE LXVI



28. SEBASTODES VEXILLARIS



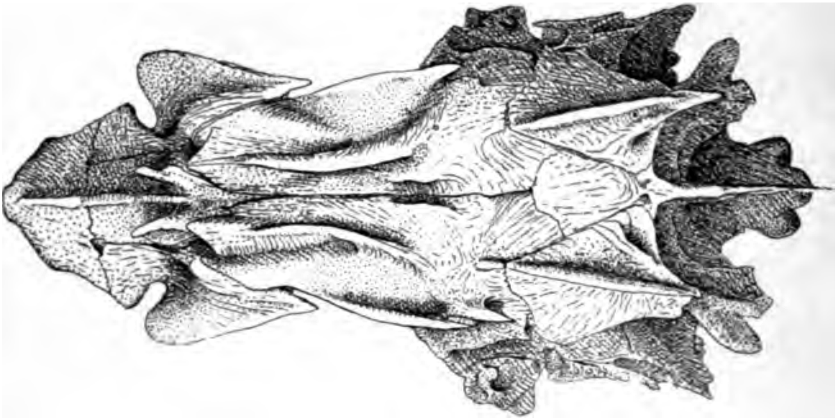
29. SEBASTODES VEXILLARIS



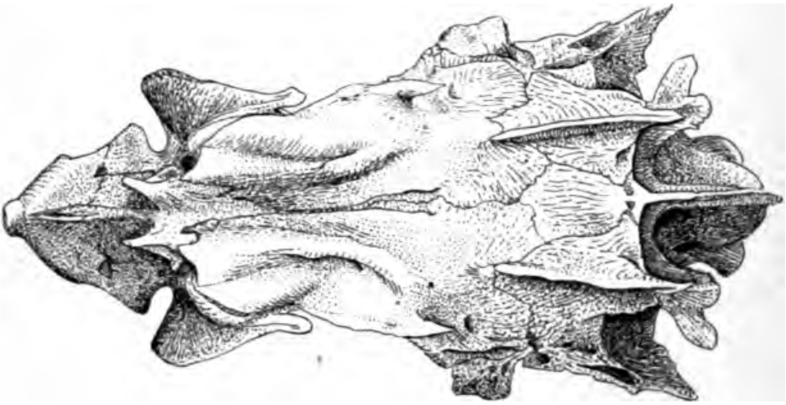
30. SEBASTODES MALIGER

Del.

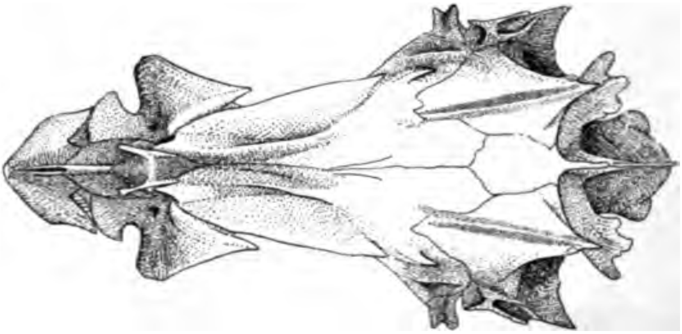
LITH. BRITTON & REY. S.F.



28. SEBASTODES VEXILLARIS



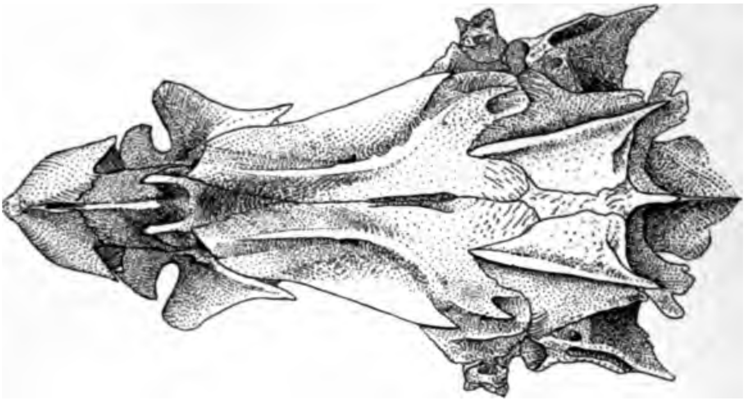
29. SEBASTODES VEXILLARIS



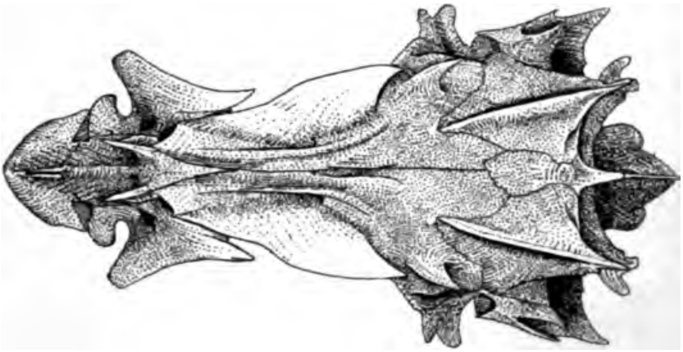
30. SEBASTODES MALIGER

L. Brown, del.

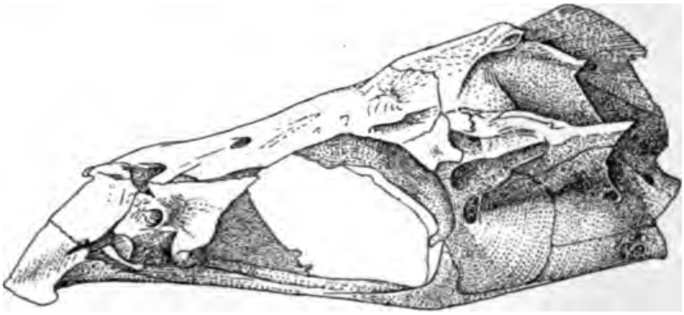
Lith. Britton & Rey.



31. SEBASTODES MALIGER



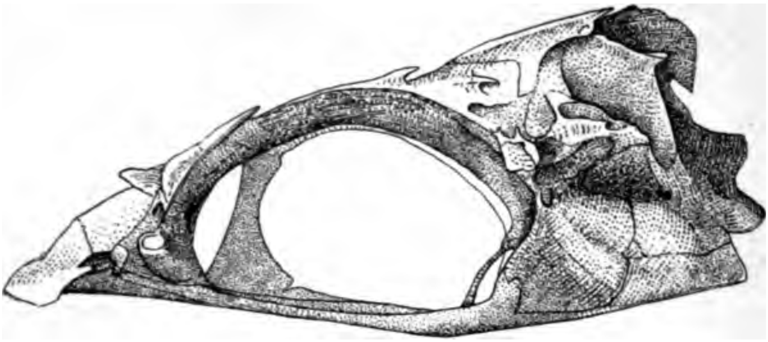
32. SEBASTODES NEBULOSUS



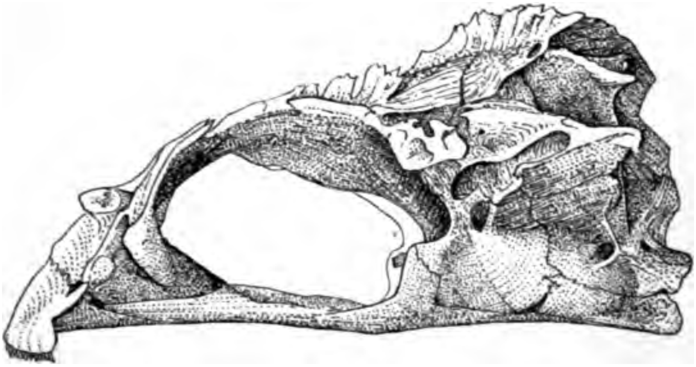
33. SEBASTODES PAUCISPINIS

Brown Lith.

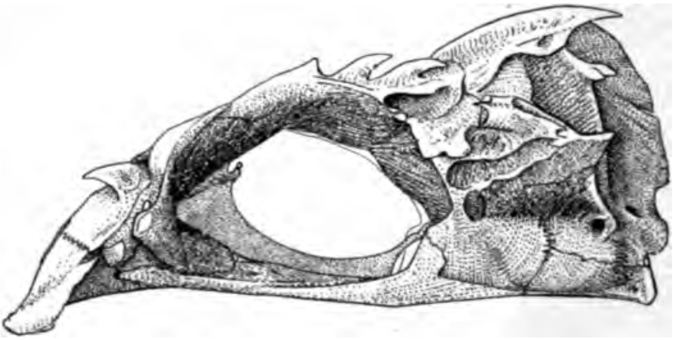
LITH. BRITTON & REY



37. SEBASTODES SAXICOLA

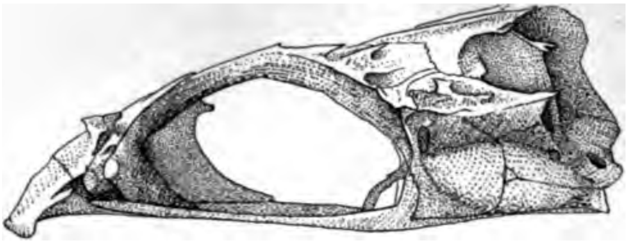


38. SEBASTODES RUBERRIMUS

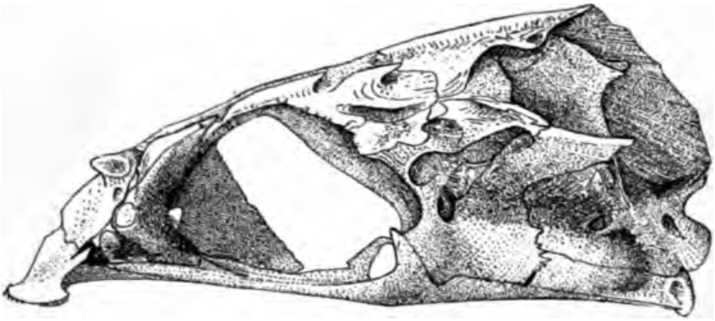


39. SEBASTODES CHLOROSTICTUS

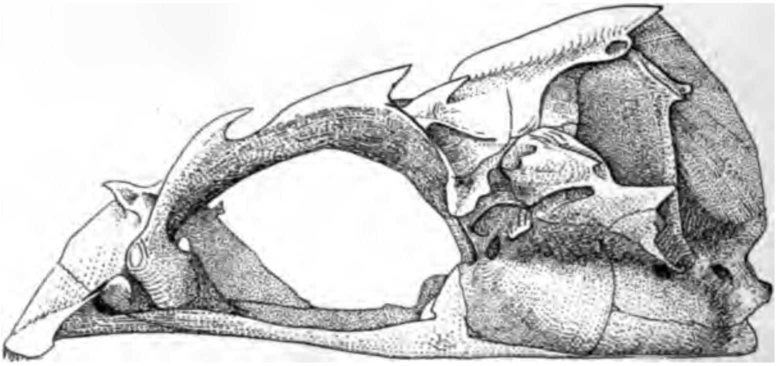
[illegible] LITH. [illegible]



40. SEBASTODES ELONGATUS

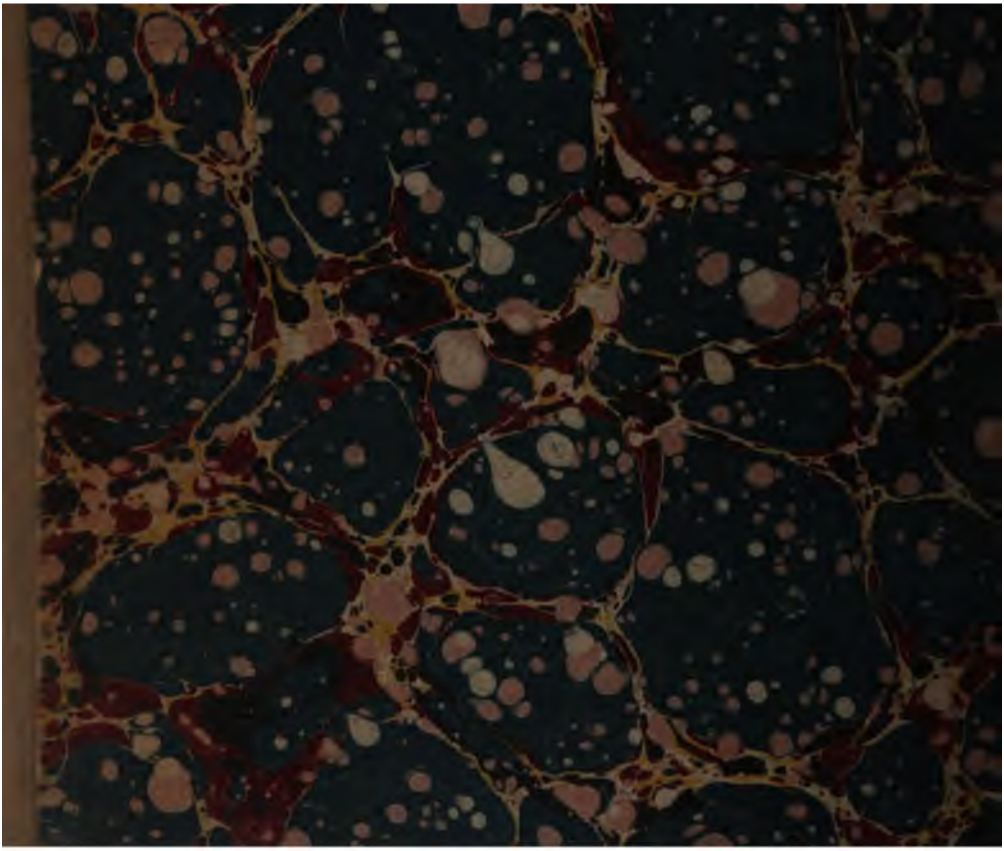


41. SEBASTODES RASTRELLIGER



42. SEBASTODES NEBULOSUS

LITH. BRITTON & REY, S.F.



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